United States Patent [19]

Kondo et al.

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[45] **Date of Patent: May 30, 1989**

[54] **APPARATUS FOR DISCRIMINATING PAPER MONEY AND STACKING THE SAME**

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[73] Assignee: **I.M. Electronics Co, Ltd.,** Osaka, Japan

[21] Appl. No.: **117,560**

[22] Filed: **Nov. 6, 1987**

[51] **Int. Cl.**[4] **G07F 7/04**

[52] **U.S. Cl.** **194/206;** 221/198; 209/534

[58] **Field of Search** 194/206, 207; 221/198, 221/227; 209/534; 232/15, 16

[56] **References Cited**

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Primary Examiner—F. J. Bartuska

Attorney, Agent, or Firm—Birch, Stewart, Kolasch & Birch

[57] **ABSTRACT**

Apparatus for discriminating paper money and stacking the same includes a main body of the apparatus and a stacker box attached thereto detachably by the use of a hooking part and a hanging part provided on the main body and the stacker box, respectively and being able to engage with each other. The main body of the apparatus includes: a passage provided with a transferring roller for transferring paper money, a sensor for discriminating the paper money, and further the passage has a stuffing part for guiding both side parts of the paper money to expose the reverse side of the paper money; and a sending part for sending the paper money through the stuffing part backward. The stacker box includes: a base box, disposed back of the main body of the apparatus, having an opening part surrounding the stuffing part, and receiving the paper money inserted through the opening part and the stuffing part by the sending part; a covering plate for shutting the opening part at the time of at least having been released the engagement of the hooking part and the hanging part; and a locking member for locking the covering plate in a shutted state.

8 Claims, 16 Drawing Sheets

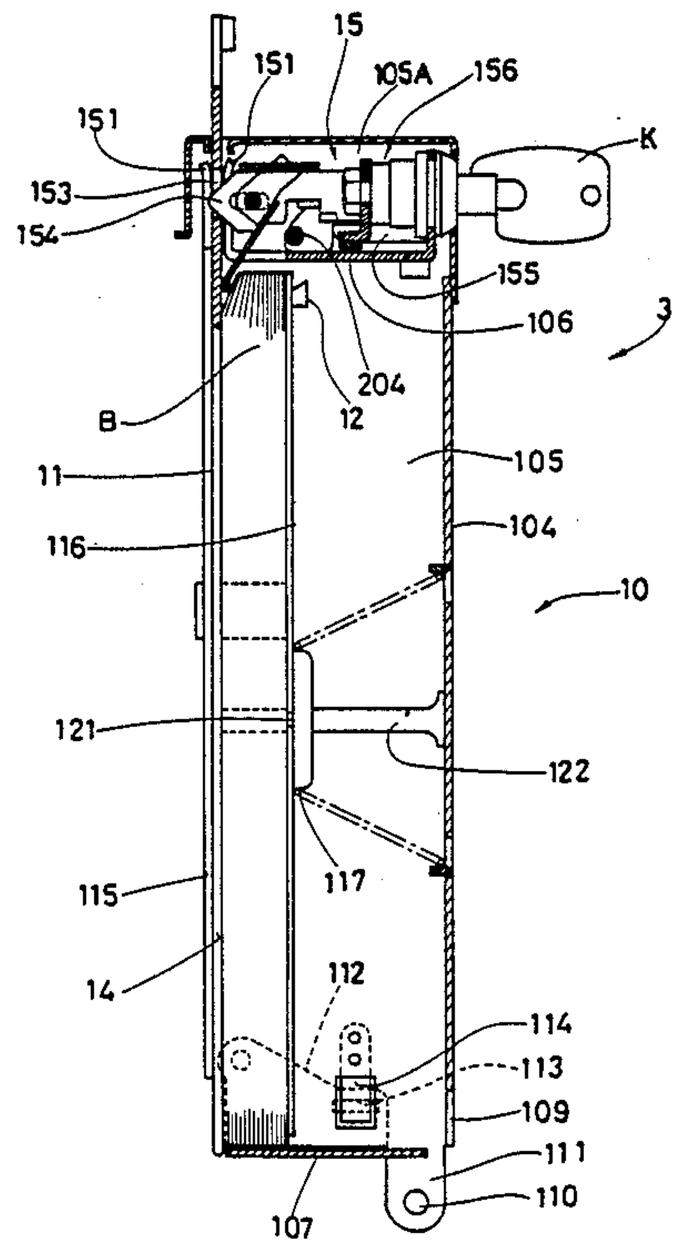


FIG.1

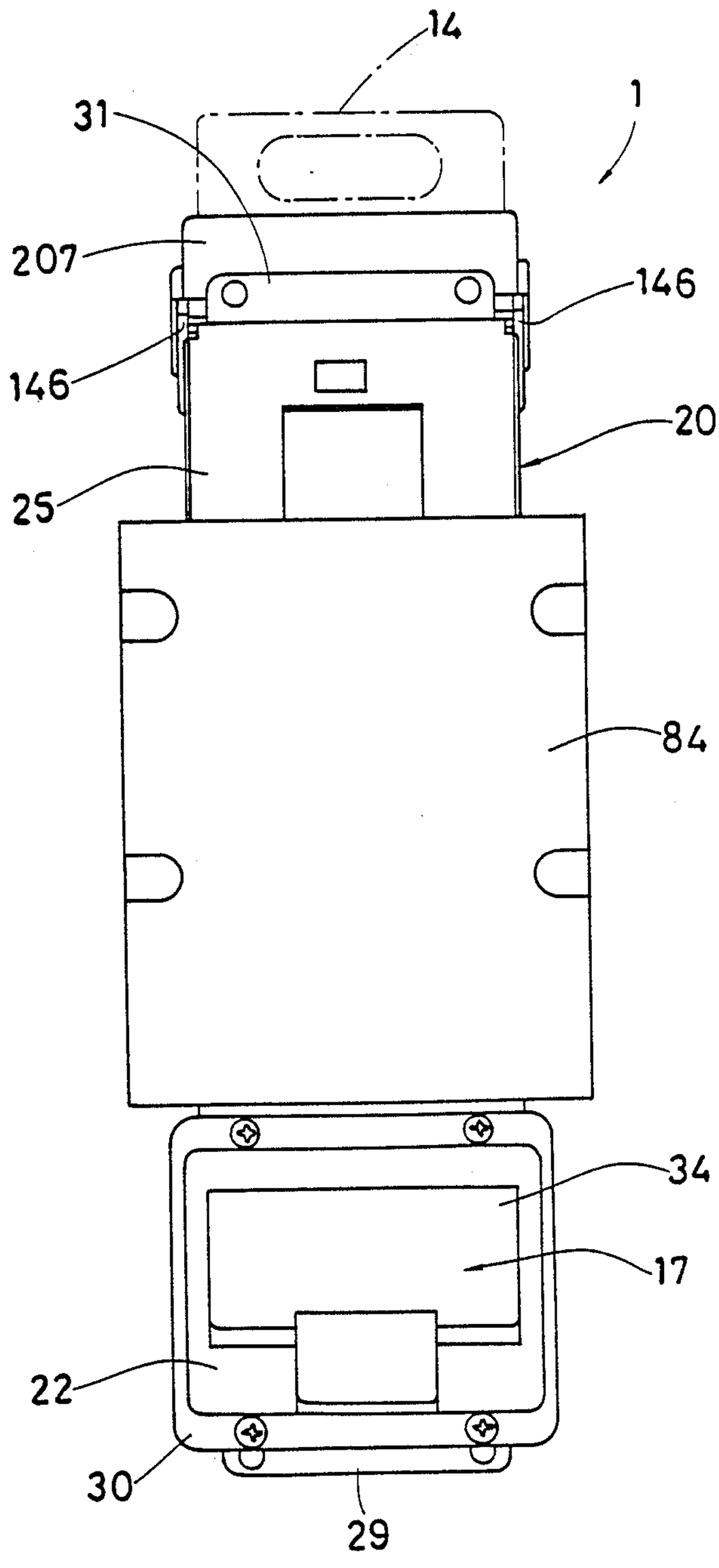
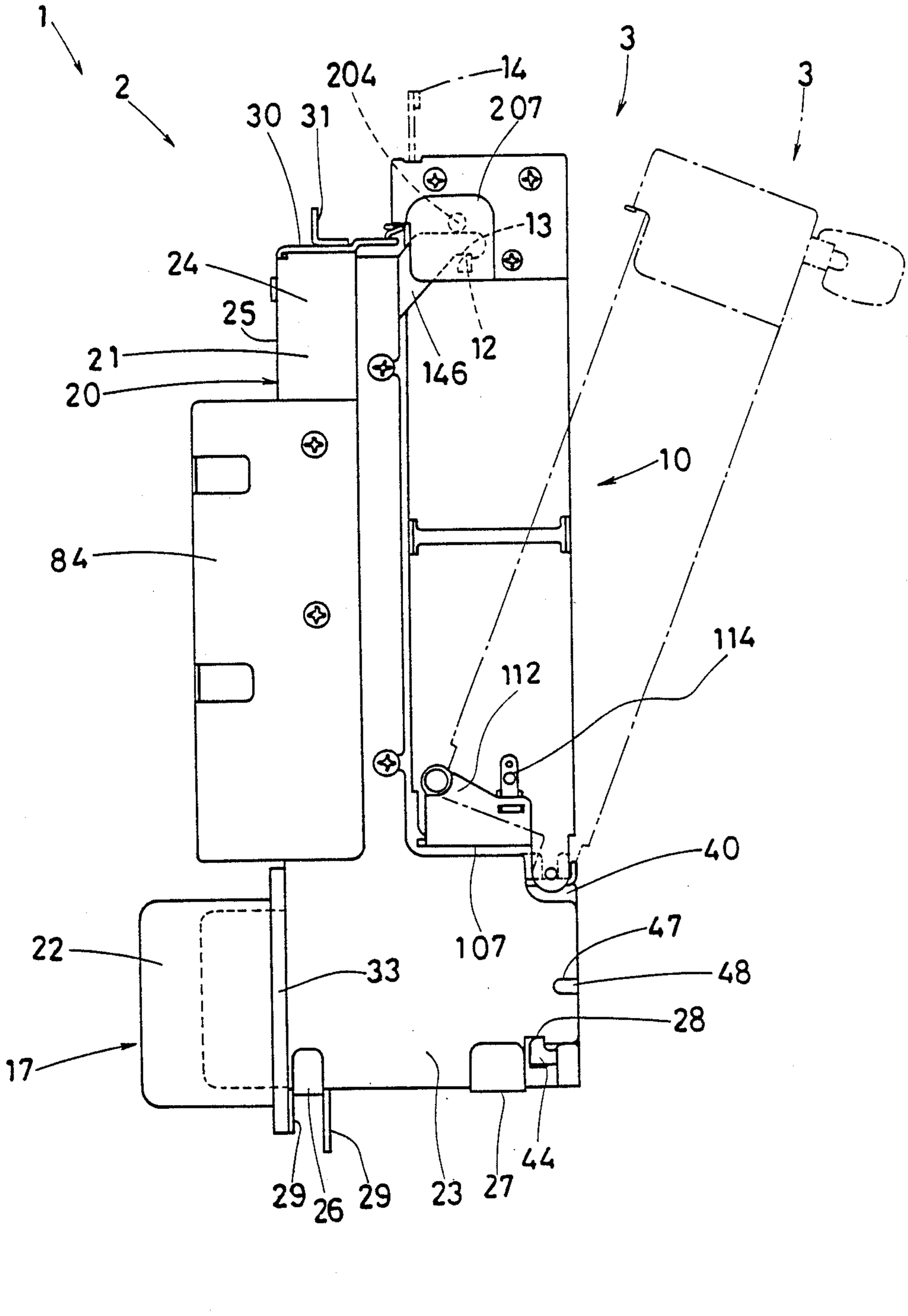


FIG. 2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24
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21
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40
47
107
48
22
33
28
17
29
26
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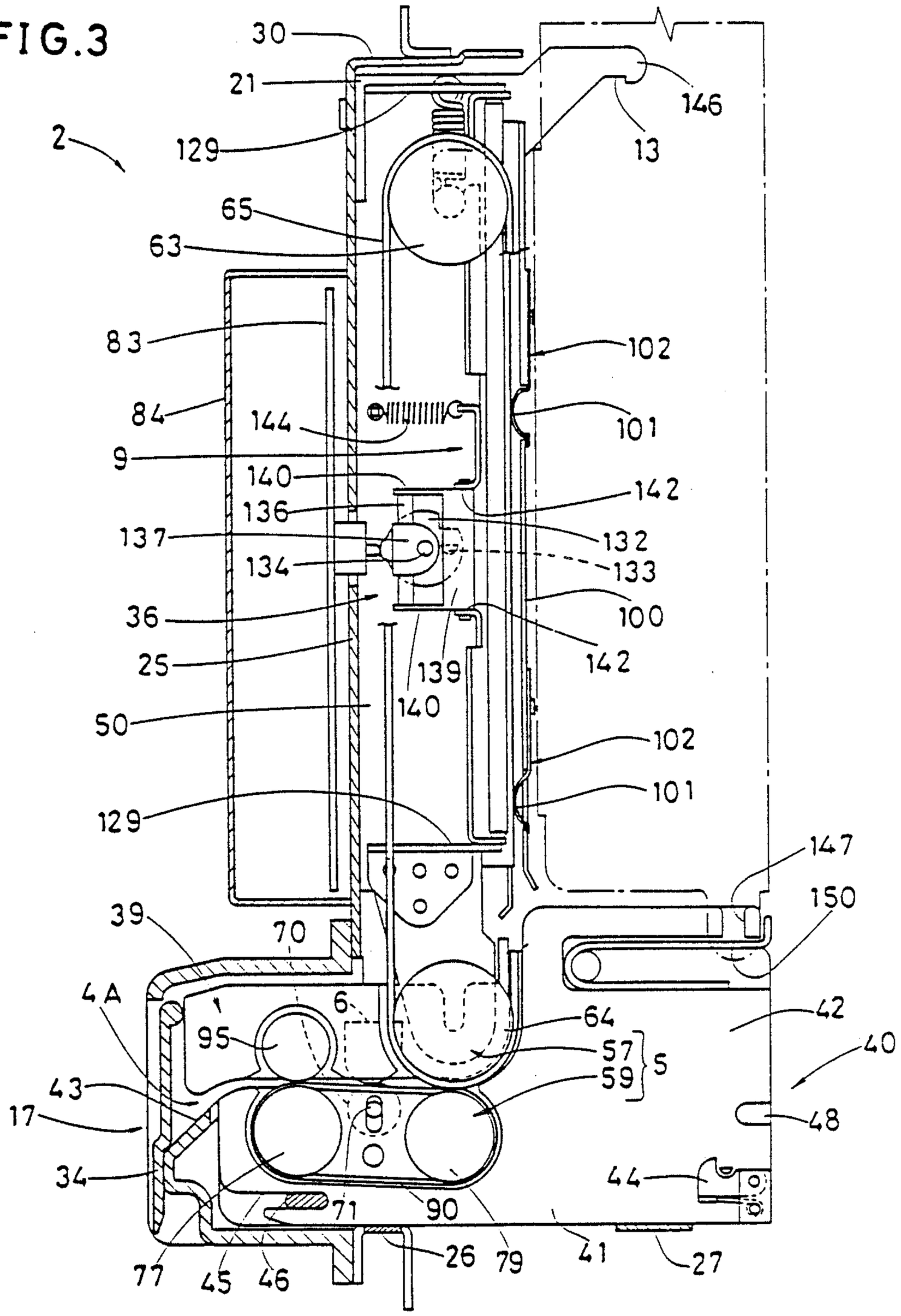
23
27
44

FIG.3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2
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65
63
83
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84
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101
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140
142
136
132
137
133
134
100
36
142
25
139
140
50
102
129
101
147
150
39
70
4A
6
64
42
95
57
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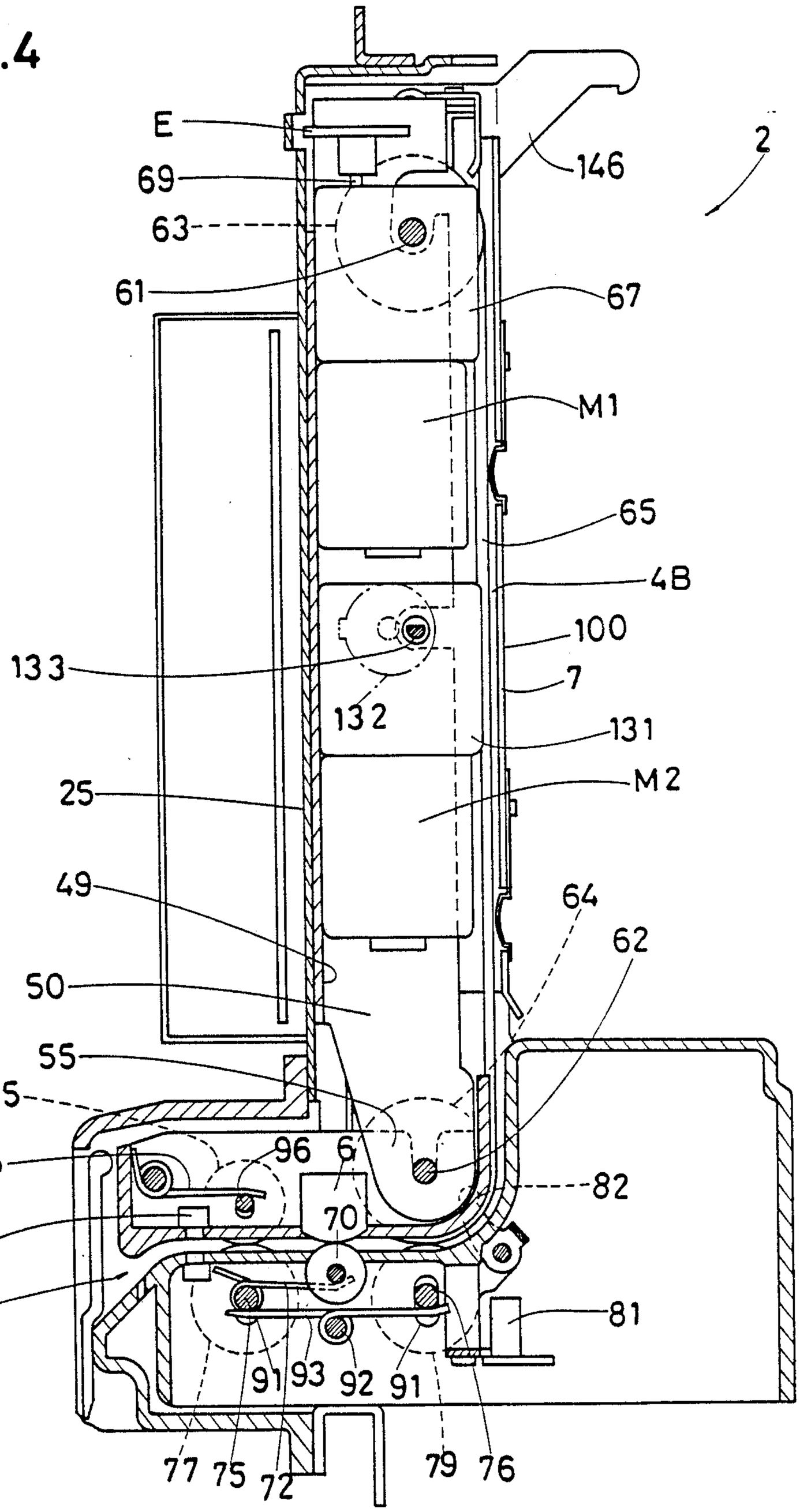
43
17
48
34
44
71
90
77
45
46
26
79
41
27

FIG.4


E
69
63
61
2
146
67
M1
65
4B
100
7
131
M2
133
132
25
49
50
55
95
94
96
6
64
62
82
80
70
4
81
91
93
92
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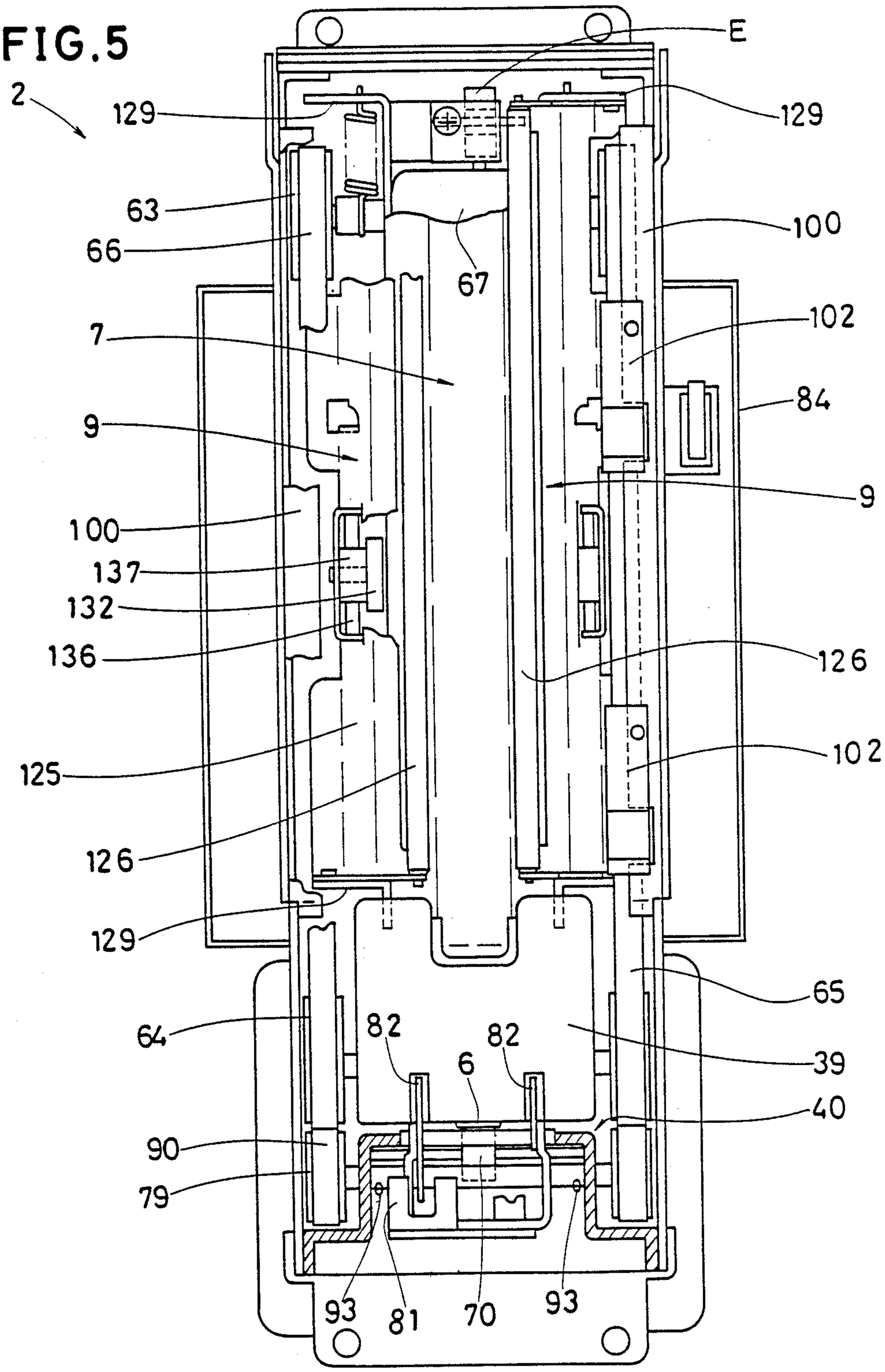
77
75
72
79
76

FIG.5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129
63
66
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9
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137
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129
E
129
67
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84
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65
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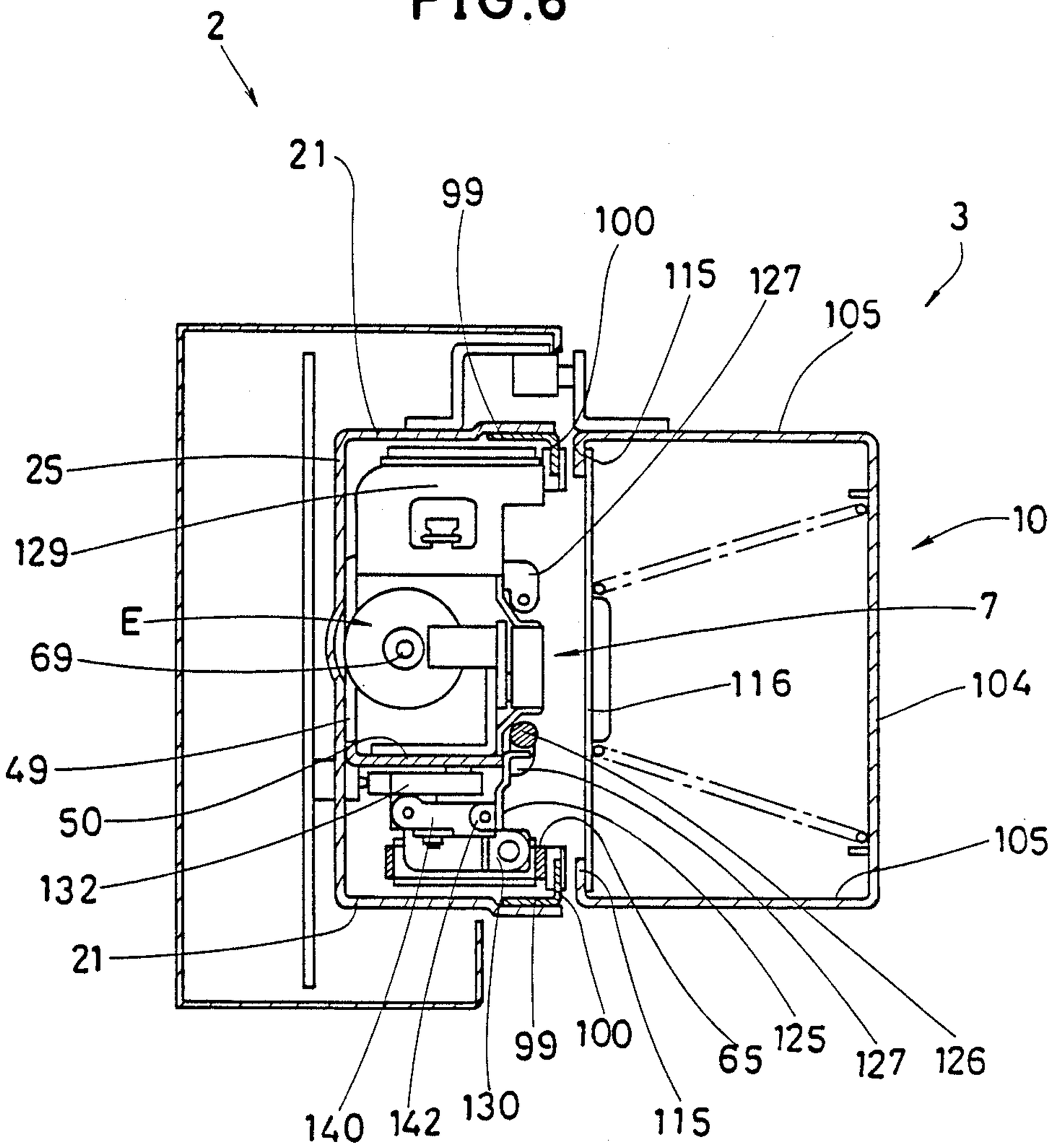
6
39
40
90
79
93
81
70
93

FIG.6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E
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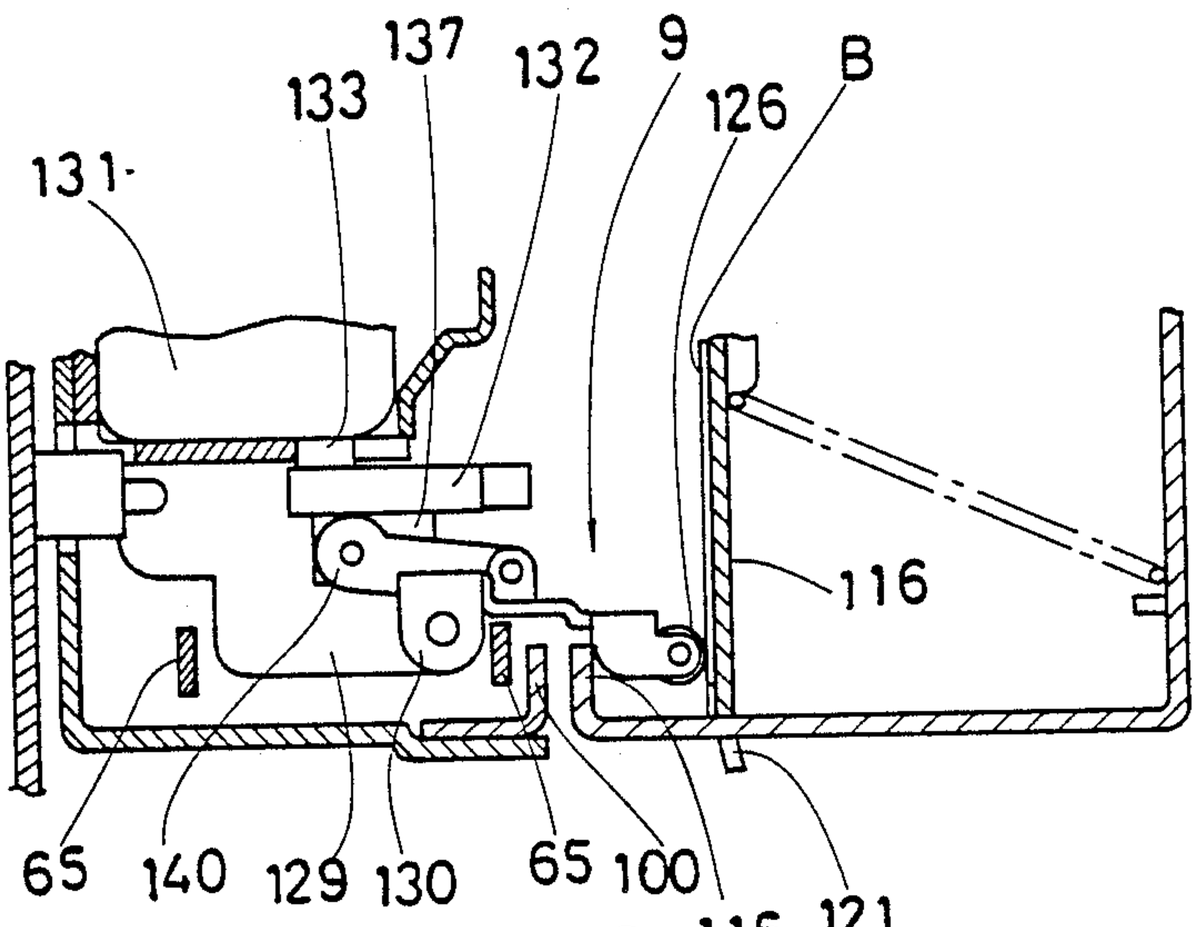
FIG.8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132
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126
B
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130
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100
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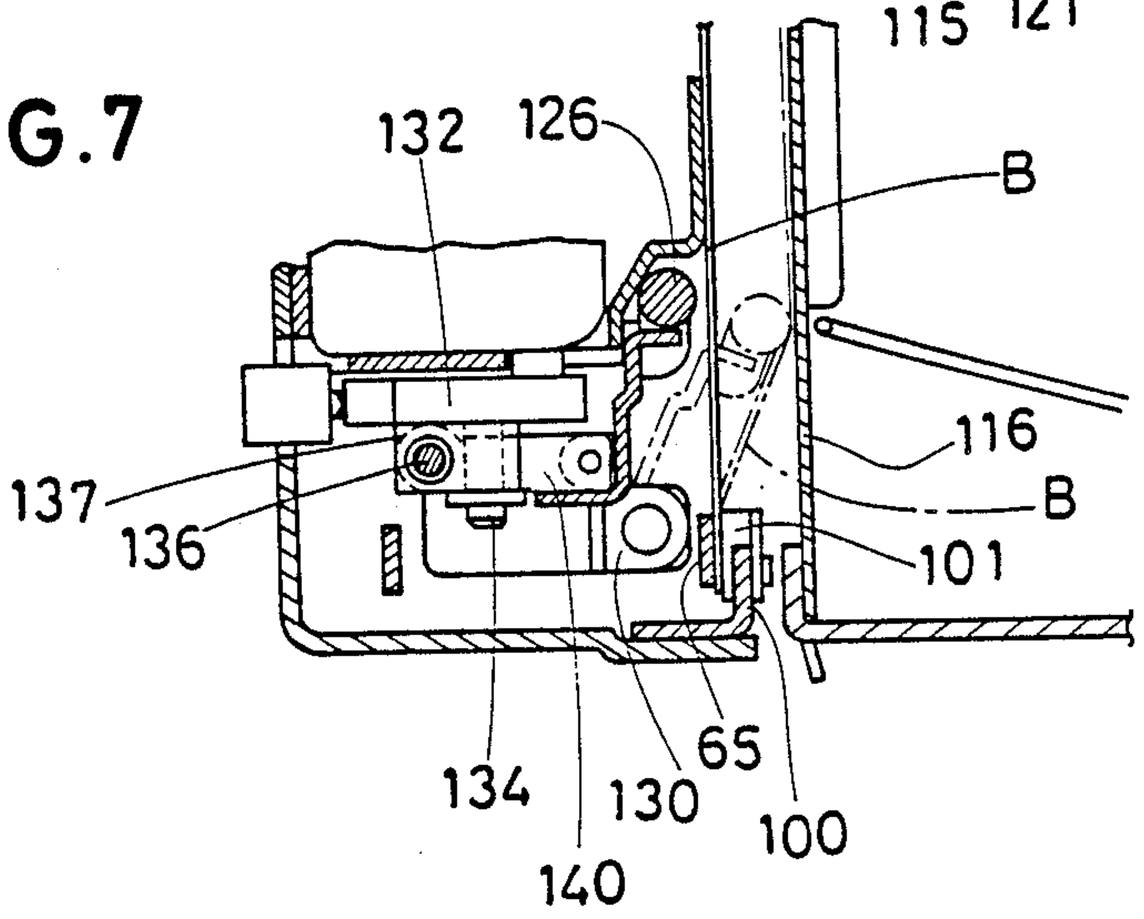
121

FIG.7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B
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137
136
B
101
134
140
130
65
100

FIG.9

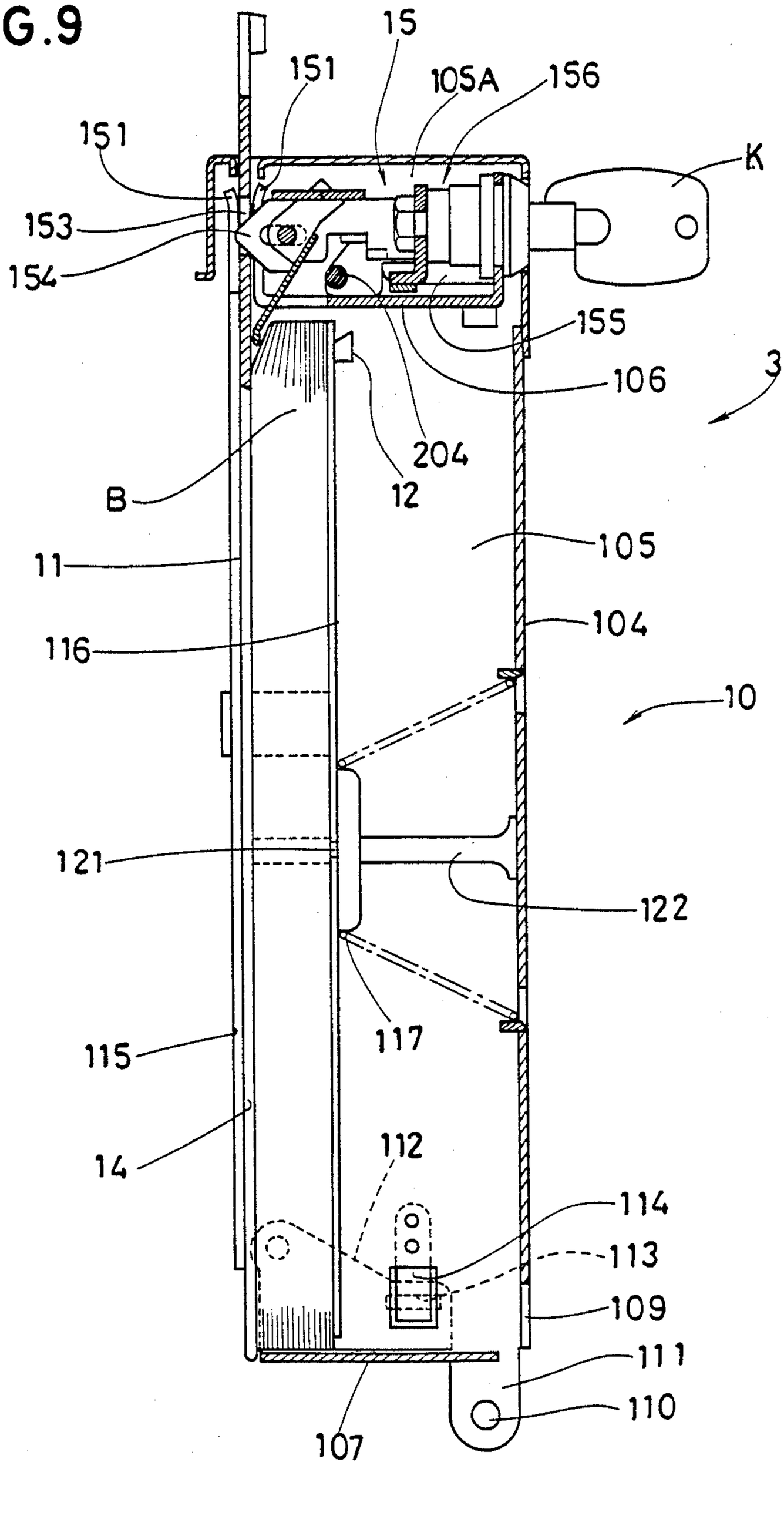
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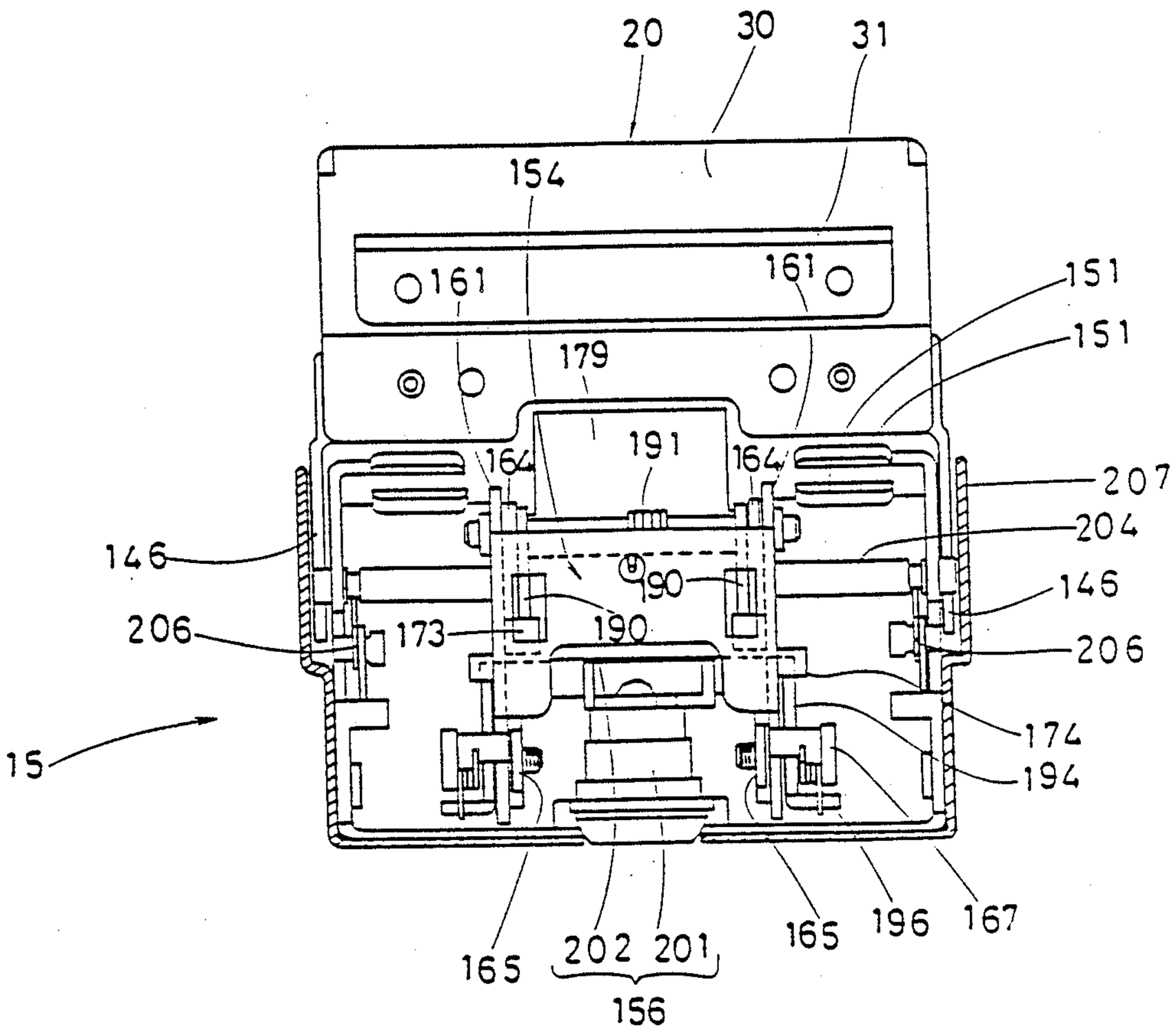
FIG.10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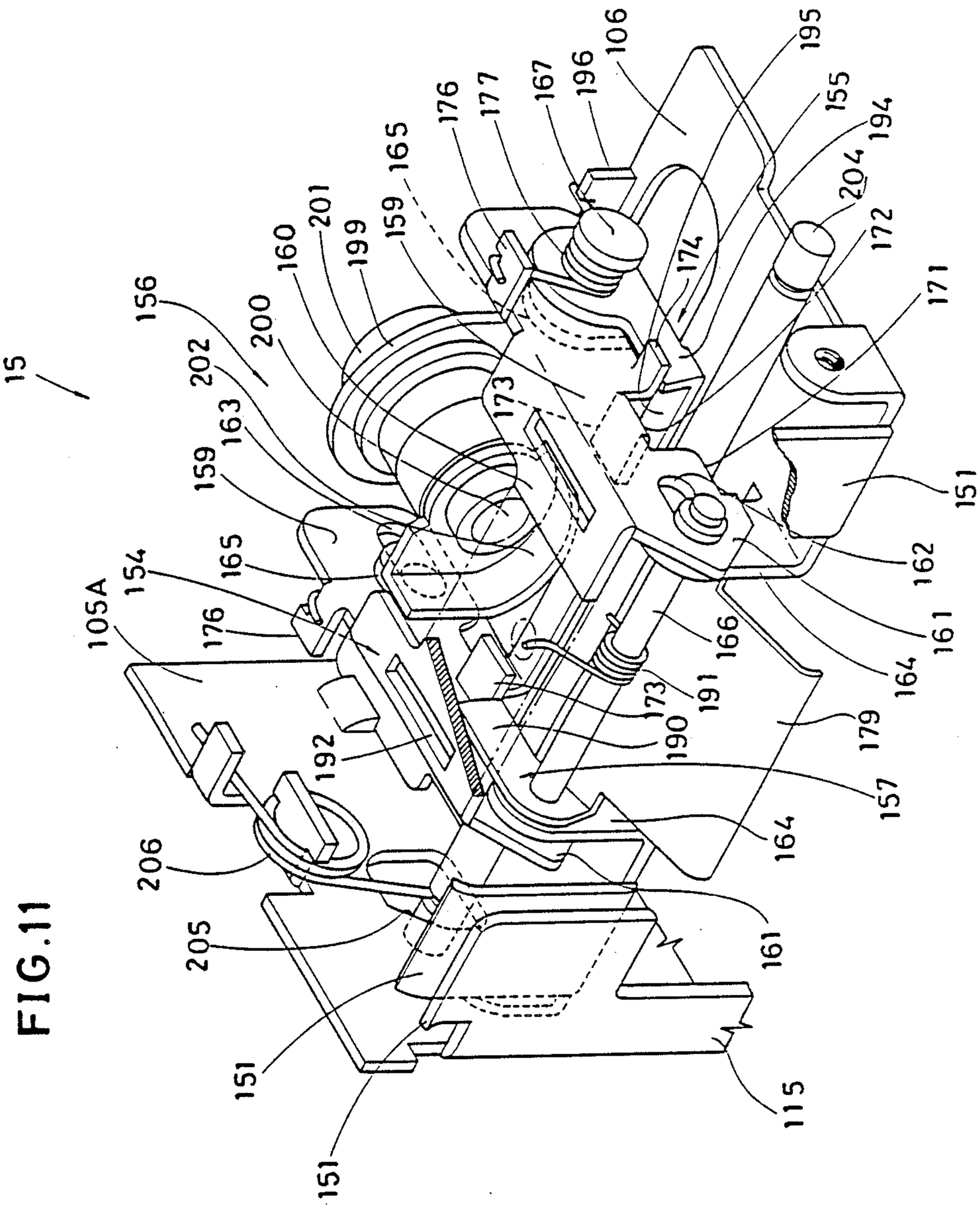
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173
163
154
105A
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115

FIG.11

FIG.12

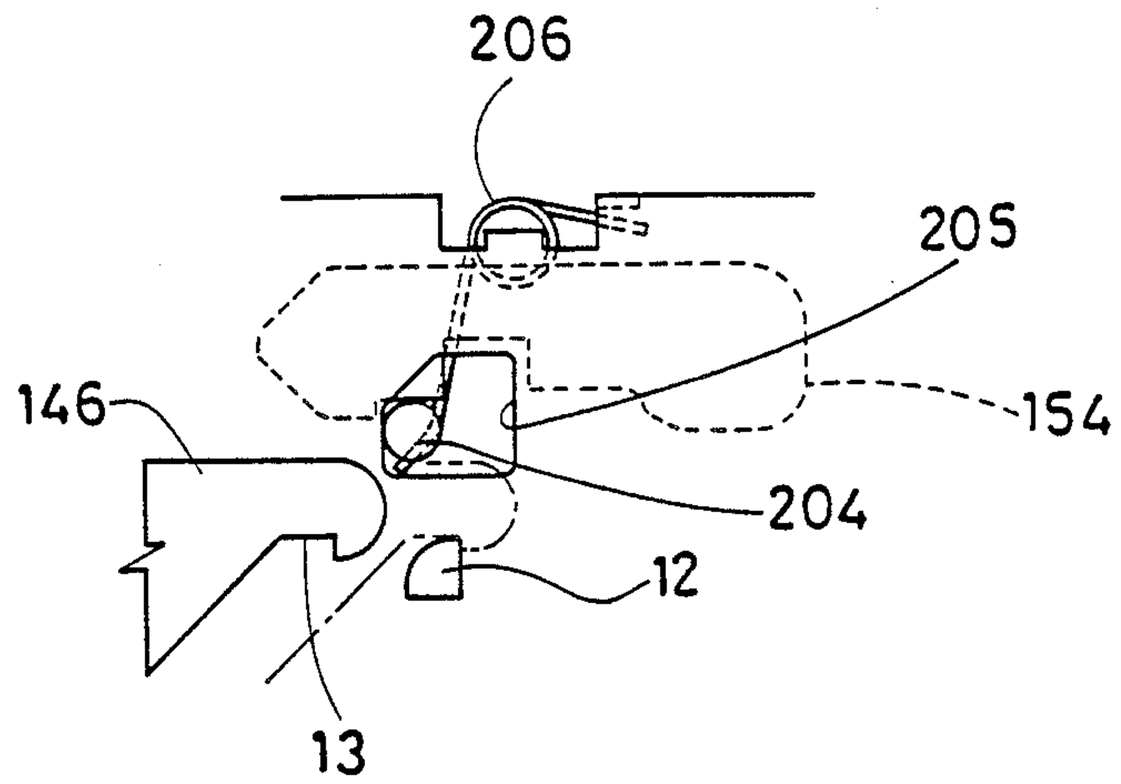


FIG.13

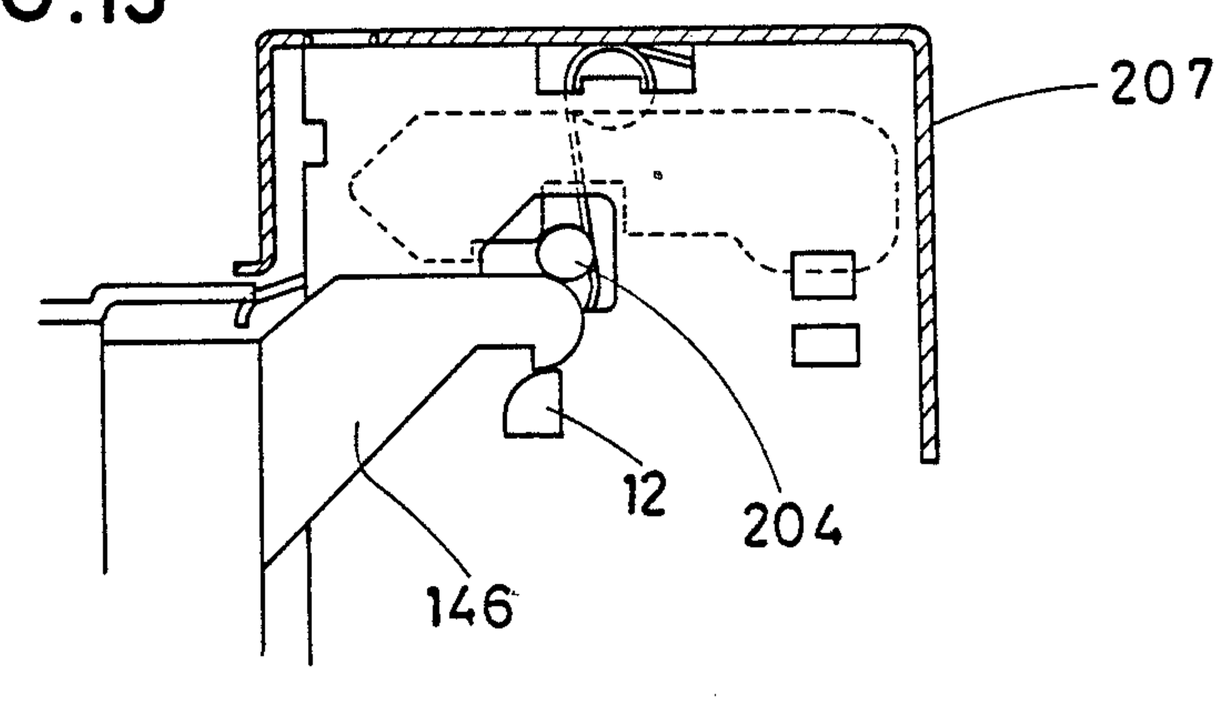
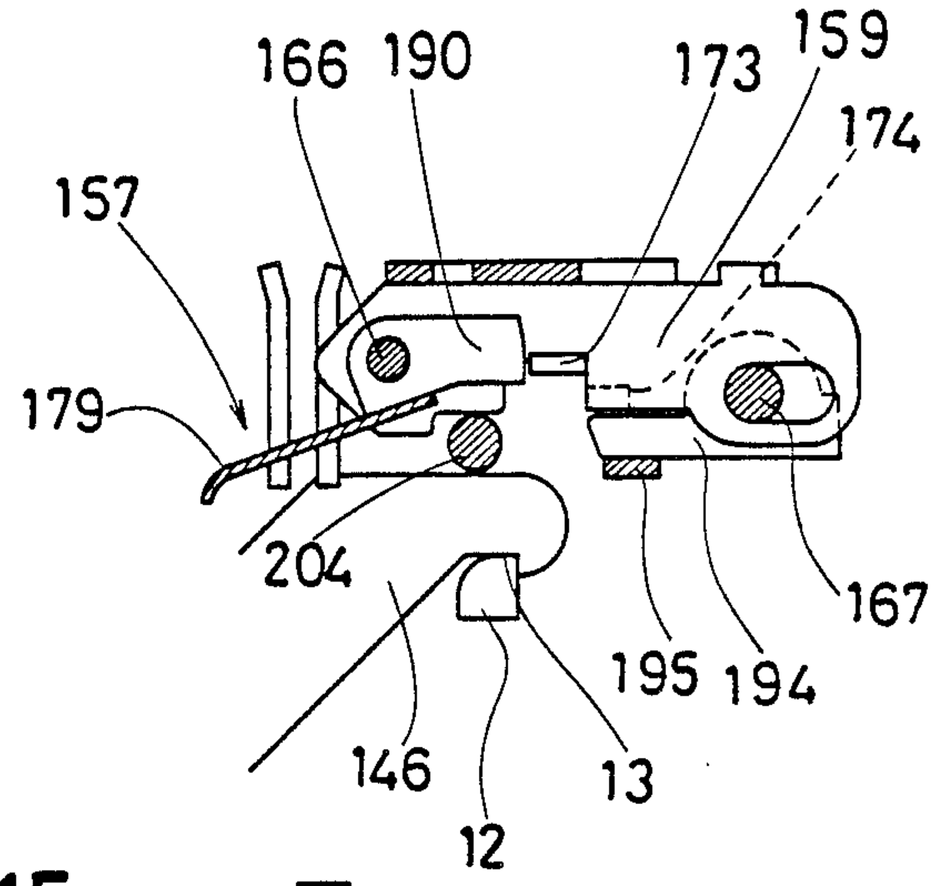


FIG.14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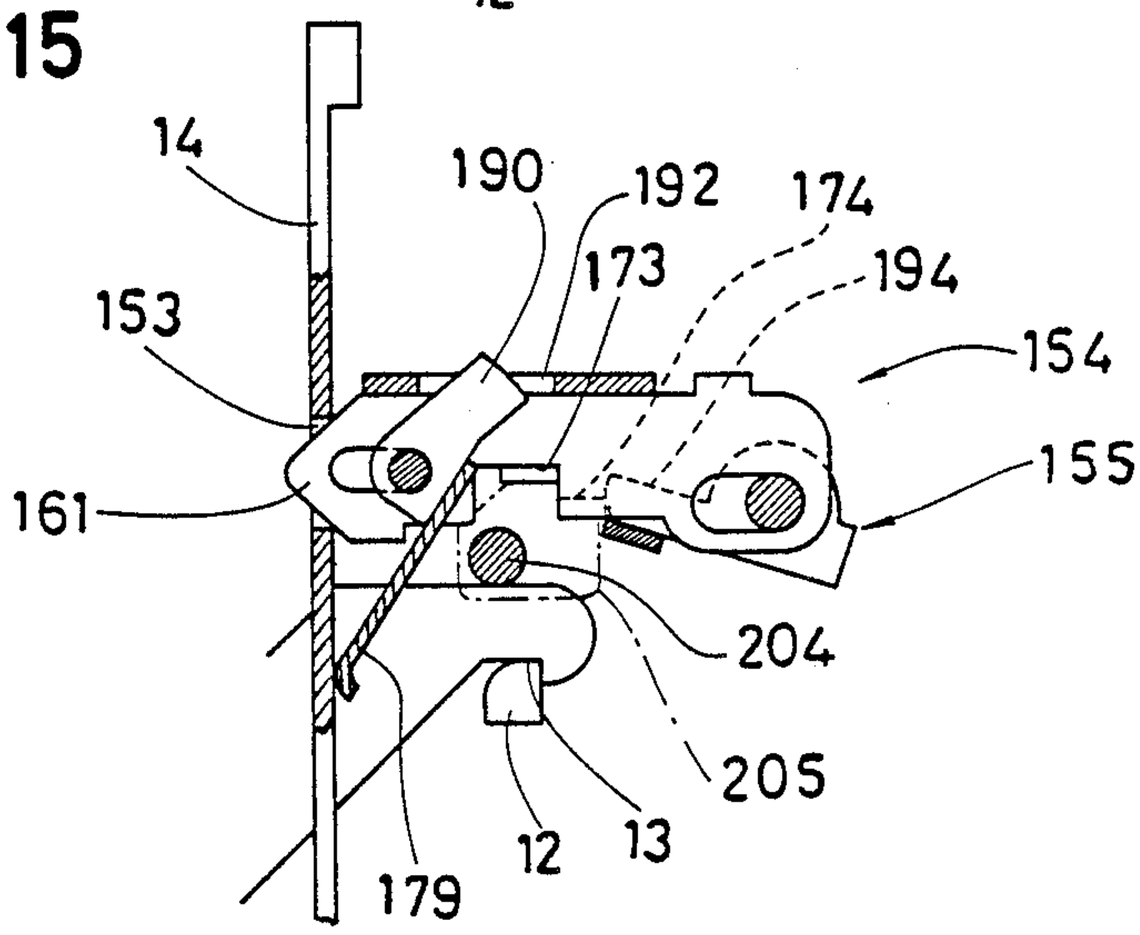
194
146
13
12

FIG.15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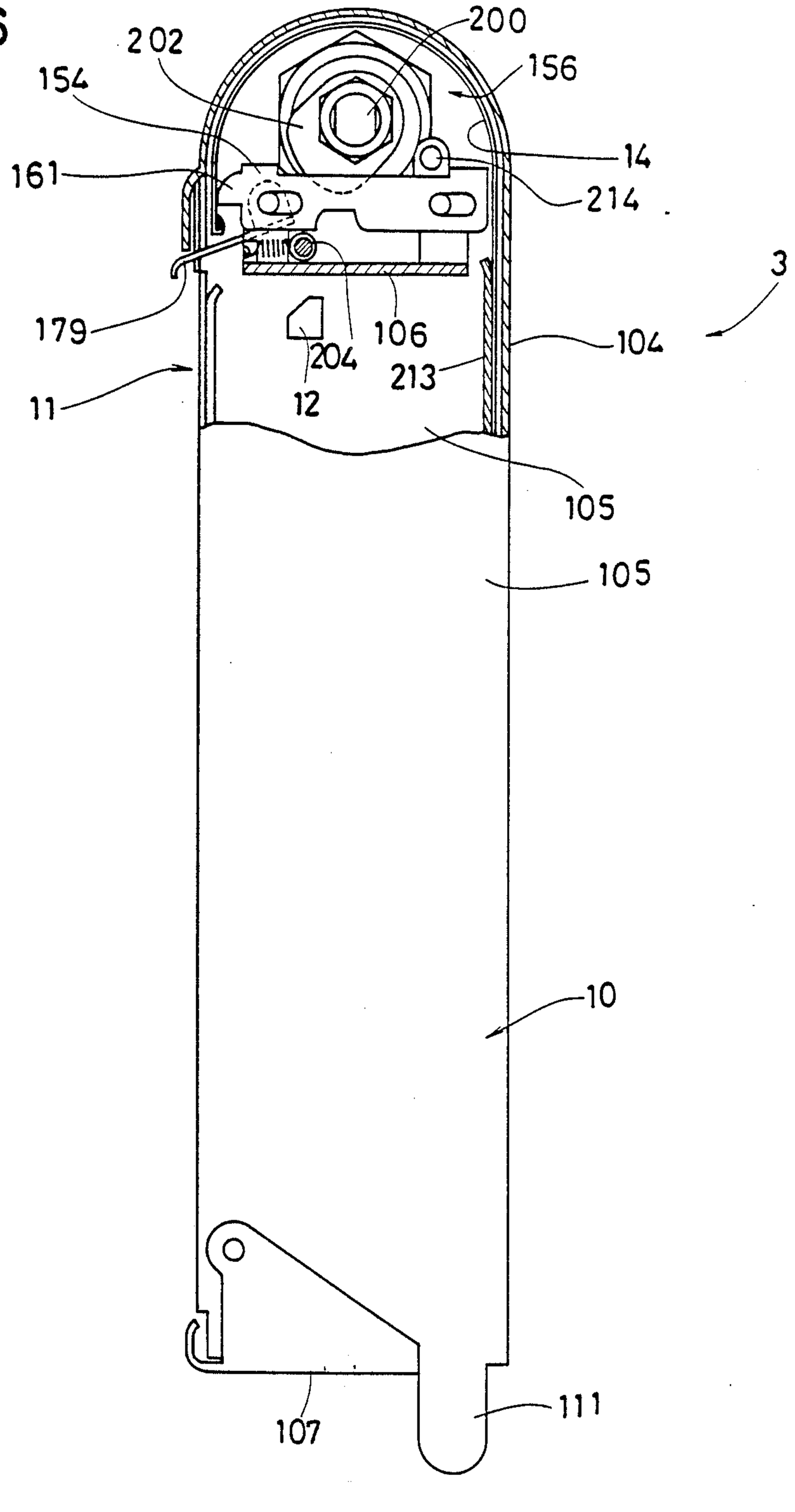
12
13
179

FIG.16


200
202
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214
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106
104
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FIG.17

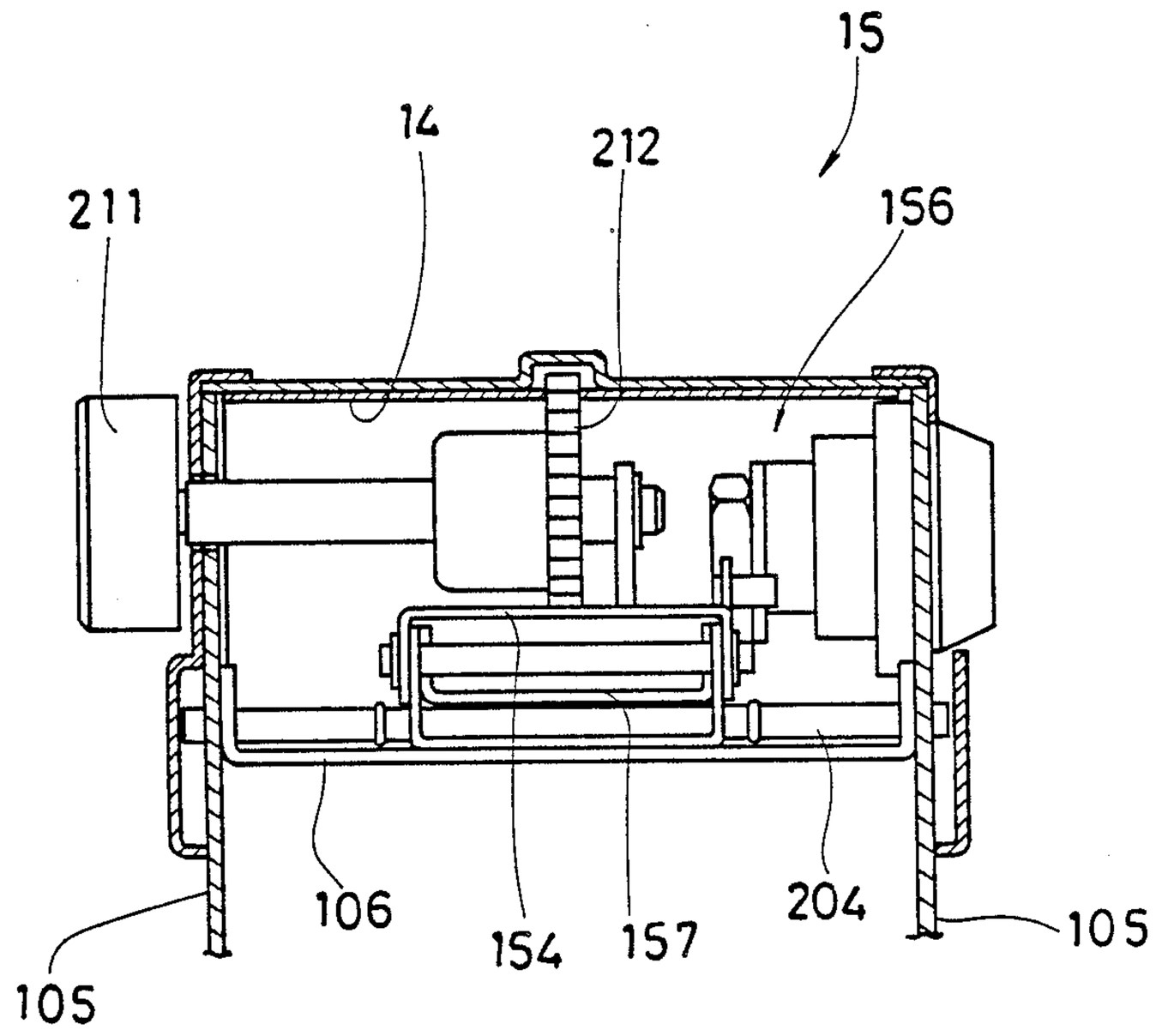


FIG.18

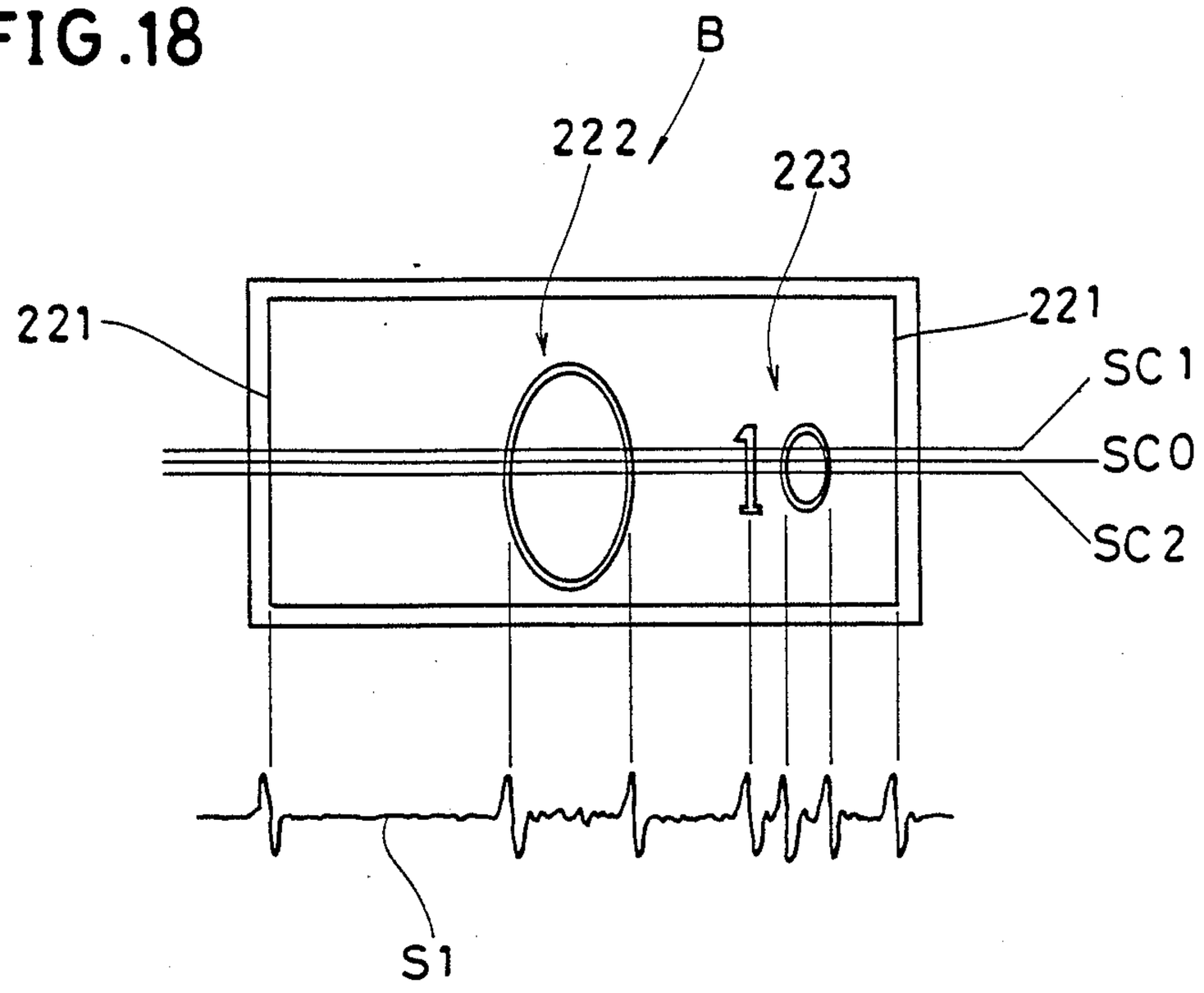


FIG.19

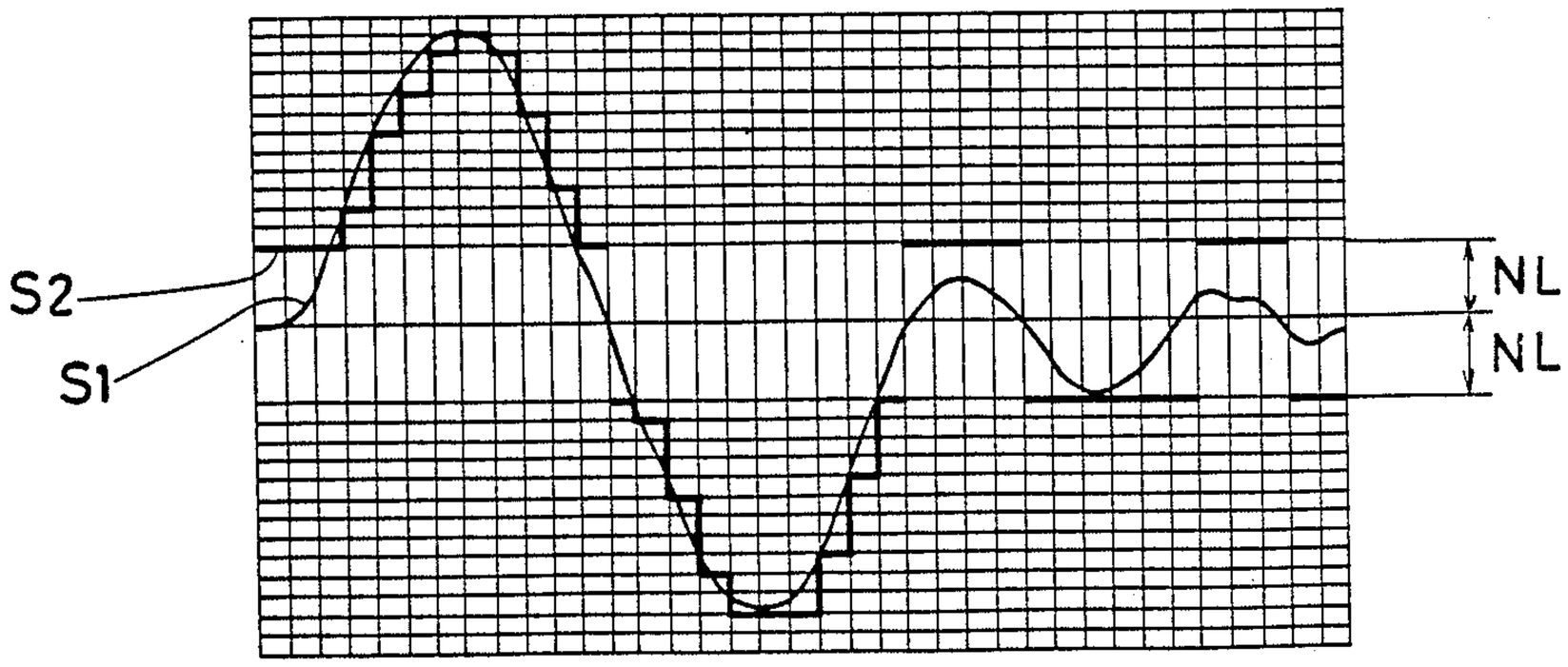


FIG.20

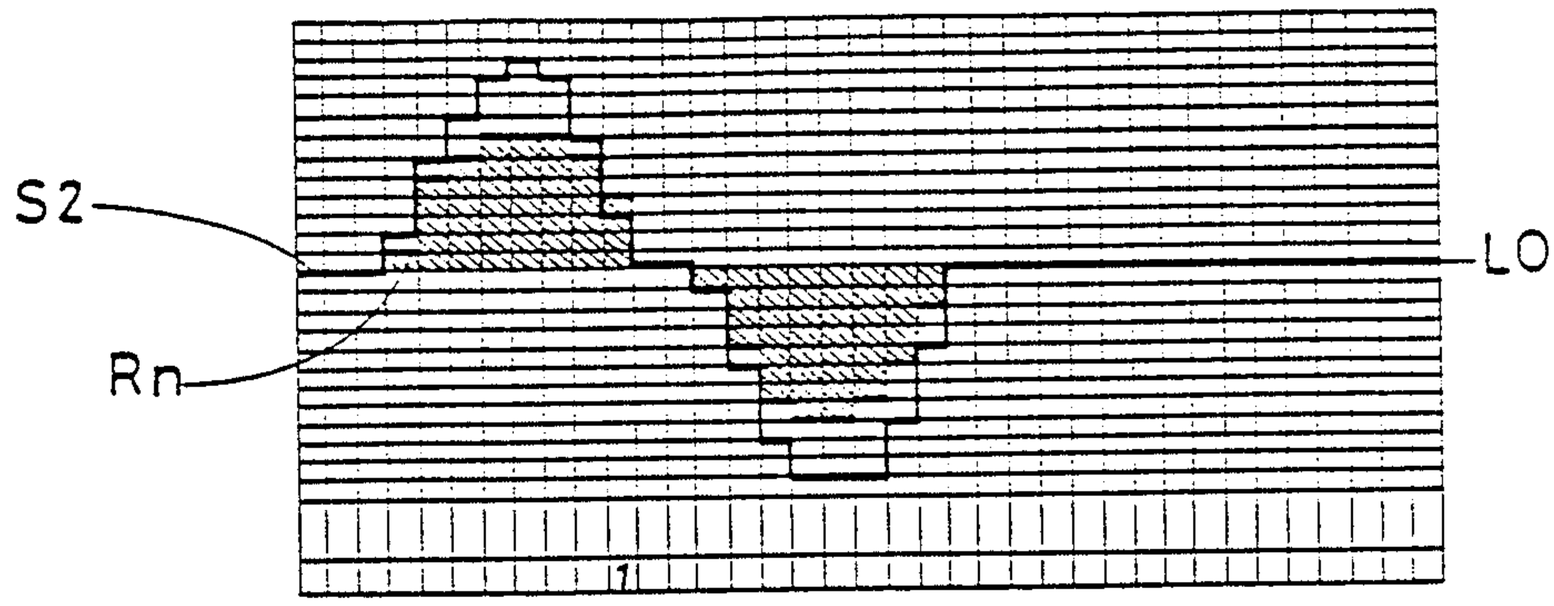


FIG.21

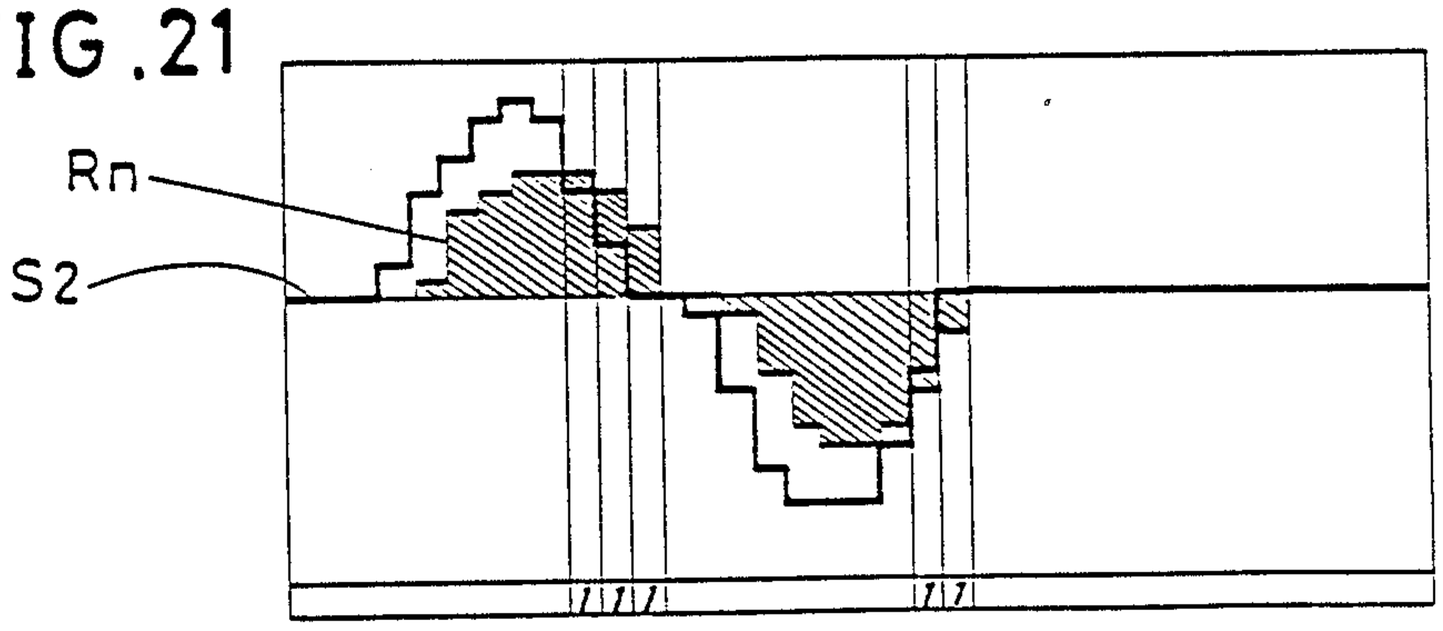
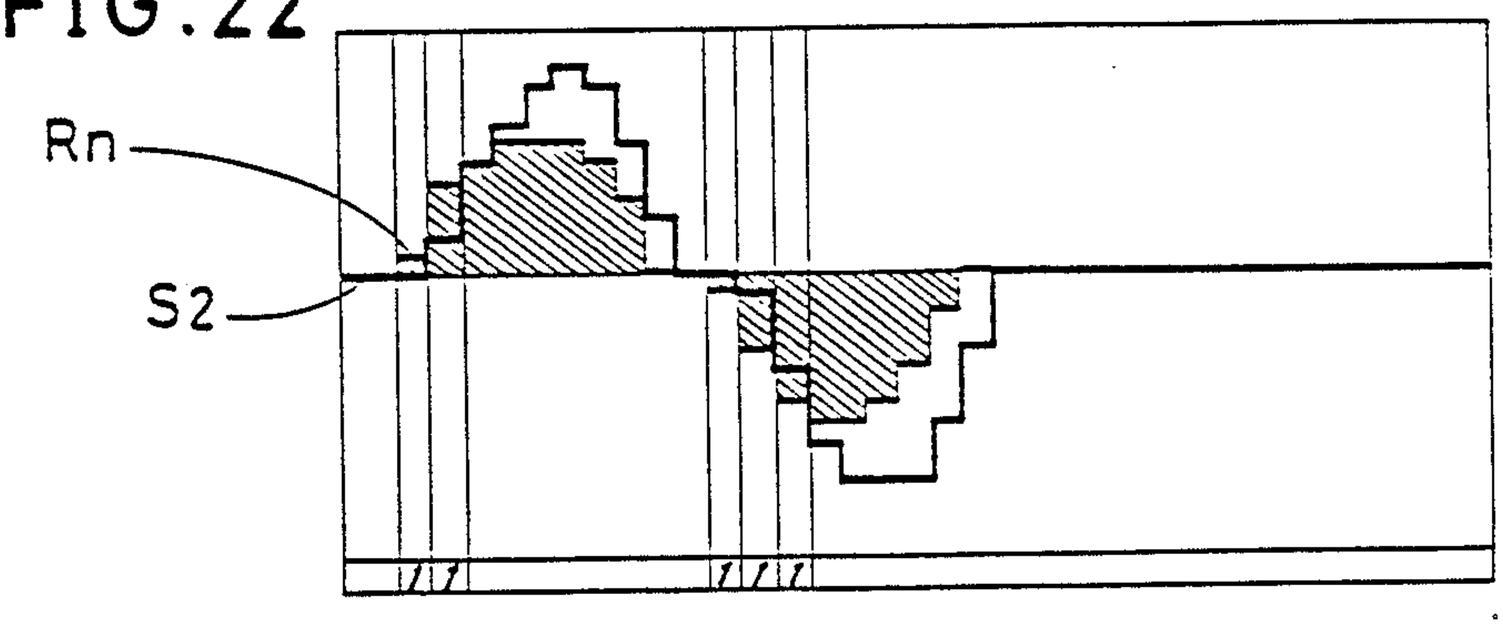


FIG.22



APPARATUS FOR DISCRIMINATING PAPER MONEY AND STACKING THE SAME

BACKGROUND OF THE INVENTION

This invention relates to an apparatus for discriminating paper money which has the ability of discriminating the authenticity of the paper money or the denomination of the same, and of receiving said money as in a stacked state.

There are used in various sorts of vending machines some kind of paper money discriminating apparatus which discriminates the genuineness or denomination of paper money and further receives the paper money discriminated as genuine notes in a stacked state. In such apparatus, there are heretofore inconveniences because of the paper money-receiving part taking the form of a box and being attached undetachably to the main body of the apparatus with the result that it is necessary to remove the paper money by grasping the received ones directly by hand, when the paper money sometimes are liable to scatter. Under these circumstances, the inventors of this invention have proposed by United States patent application Ser. No. 817,587 pending **311** an apparatus for discriminating paper money with a stacking means which is able to solve the controversial point as mentioned above and enables the collecting operation to be rapid and efficient by forming the paper money-receiving stacker box in what is called a detachable cartridge type.

And yet, since such a stacker box as mentioned above has a relatively large opening part for inserting paper money into the interior, the received paper money are within a range of the taker's eye at the time of collecting and consequently can be easily taken out, which threatens to induce dishonest pilferage when collecting.

SUMMARY OF THE INVENTION

An object of this invention is to provide an apparatus for discriminating paper money with a stacking means which has the ability to solve the controversial point as mentioned above on the basis of having a covering plate to shut the opening part and a locking means to lock the covering plate in a shut state thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front elevation showing an example of the invention;

FIG. **2** is a side elevation thereof;

FIGS. **3** to **5** are longitudinal sectional views thereof;

FIG. **6** is a transverse sectional view;

FIGS. **7** and **8** are cross sectional views showing the working of the sending tools;

FIG. **9** is a cross sectional view showing the stacker box thereof;

FIG. **10** is a top plan view showing the locking tool thereof;

FIG. **11** is a perspective view thereof;

FIGS. **12** to **15** are diagrams showing the working thereof;

FIG. **16** is a cross sectional view showing another example of the stacker box;

FIG. **17** is a cross sectional view showing the locking tool thereof; and

FIGS. **18** to **22** are type illustrations explaining the discriminating method of the paper money.

DETAILED DESCRIPTION OF THE INVENTION

Description will be now directed to an embodiment of this invention with reference to the accompanying drawings taking as an example the case where the apparatus for discriminating paper money with the stacking means according to a invention is formed in the capacity of a unit body which is to be incorporated into an apparatus such as, for example, a vending machine.

In the figure, the apparatus for discriminating paper money and stacking the same **1** comprises a main body **2** of the apparatus and a stacker box **3** attached thereto detachably by means of a hooking part **13** and a hanging part **12** provided on the main body **2** and the stacker box **3**, respectively and being able to engage with each other. The main body **2** of the apparatus comprises: a passage **4** provided with transferring means **5** for transferring a paper money B in a developing state and with a sensor **6** for discriminating the paper money B, and further the passage **4** has a stuffing part **7** for guiding both side parts of the paper money B to expose the reverse side of the paper money B; and a sending means **9** for sending the paper money B through the stuffing part **7** backward. The stacker box **3** comprises: a base box, disposed back of the main body **2** of the apparatus, having an opening part **11** surrounding the stuffing part **7**, and receiving the paper money B inserted through the opening part **11** and the stuffing part **7** by the sending means **9**; a covering plate **14** for shutting the opening part **11** at the time of at least having released the engagement of the hooking part **13** and the hanging part **12**; and a locking means **15** for locking the covering plate **14** in a shutted state.

The main body **2** of a apparatus is possessed of the base frame **20**. As shown in FIGS. **2** and **6**, this base frame **20** raises erectly the upper plate part **24** narrow in width on the middle part of the lower plate part **23**, and is possessed of plates **21**, forming a reverse T-shape and a frontal plate **25** joining the front ends of the above-mentioned upper plate part **24**. On the other hand, at the lower ends of the side plates **21**, joining pieces **26** and **27** are spanned across. Beneath the joining piece **26** is fitted the fitting piece **29**. Further, on the upper end of the frontal plate **25** is formed an upper plate **30** through bending. On this upper plate **30** is raised erectly a fitting piece **31**. The frontal cover **22** being fitted to the lower end part of the base frame **20** constitutes a square cylinder shape surrounding the frontal end parts of the above-mentioned lower plate parts **23** and is fixed on the above-mentioned fitting piece **29** and on the front face of the frontal plate **25** by a flange **33** being formed on the rear end. The opening part on the front face of the frontal cover **22** forms an inserting port **17** through which the paper moneys B are to be inserted. This inserting part **17** is provided with an opening or shutting lid **34** which can be sprung up.

Further as shown in FIGS. **3** and **4**, to the base frame **20** are fitted an upper block piece **39** and lower block piece **40** between the lower plate parts **23**.

There is provided on lower block piece **40** at the rear fringe of the basal part **41** which is nearly the same in depth as the above-mentioned lower plate part **23** a projecting part **42**, of which the form of a side face is L-shaped. The front end part of the above-mentioned basal part **41** is inserted into the frontal cover **22**, and its front end impinges against the lower end part of the opening and shutting lid **34**. The upper face of the basal

part **41** forms at the rear end of its horizontal plane a smooth circular arced face continuing to the vertical front face of the projecting part **42**, and also forms at its front end a guiding part **43** being composed of an inclined surface hanging down forward.

The upper block piece **39** is arranged spacing an almost fined interval above the basal part **41** of the above-mentioned lower block piece **40**. This interval continues to the above-mentioned inserting part **17** and forms the lower passage **4A** through which the paper monies B are transferred. Accordingly, this lower passage **4A** is provided from before in order with the guiding part **43**, the horizontal part, the circular arced part, and the vertical part, and guides the paper money B being inserted horizontally in an upward state as they are.

The upper and lower block pieces **39** and **40** are formed with a hollow-shape. The lower block piece **40** is fitted up extractably in the backward direction when the projecting piece **46** which is provided protuberantly on the inner face of the above-mentioned side plate **21** engages the groove **45** which is formed on the front fringe of the side face and further when the projecting piece **48** which is provided protuberantly on the above-mentioned side face engages the groove **47** which is formed on the rear fringe of the side plate **21**. Besides, the lower block piece **40** is fixed on the base frame **20** when the hook **44** which is encouraged by a spring being fitted on the side face hooks the engaging part **28** where the rear fringe of the side plate **21** is notched in the form of a L-shape.

To the side plates **21** of the above-mentioned base frame **20** are attached guide fittings **99**. The guide fitting **99** takes the form of an L-shaped cross section which forms orthogonally an inward-facing guide piece **100** on the rear end of the fitting piece to be fixed on the rear end part of the upper plate part **24** over the side plates **21**. The guide piece **100** is provided both on the nearly middle part and the lower end part with the keep tool **12** which is possessed of the circular arced projecting part **101** being composed of leaf springs and protruding in the forward direction. Further, there is formed on a lower end of the guide piece **100** the guiding part being bent backward.

There is fitted in the interior of the base frame **20** an inner frame **19**. This inner frame **19** takes the form of a U-shaped cross section by forming side plates **50** on both side fringes of the frontal plate **49** which is fixed on the above-mentioned frontal plate **25**. On the other hand the lower end parts of the side plates **50**, constitute inserting parts **55**, to be inserted into the rear end part of the above-mentioned upper block piece **39**.

The transferring tool **5** consists of a first transferring tool **57** which is disposed in a inner frame **19** and driven by the transferring motor **M1**, and the second transferring tool **59** which is arranged on the upper block piece **39** and the lower block piece **40** and which is driven by the first transferring tool **57**.

First transferring tool **57** fixes fast the rotary bodies **63** and **64** on the both ends of the supporting shafts **61**, **62** piercing through both the upper end part of the side plate **50** and the inserting part **55**, and is wound round with endless link cords **65**, being made up of timing belts between the rotary bodies **63** and **64**. The supporting shaft **61** forms the gear unit **67** together with the worm wheel, the worm gear and the like, and makes a retardative revolution by the rotation of the transferring motor **M1**. Therefore, the running-backward line of the endless link cord **65** moves up and down owing to the normal or reverse rotation of the transferring motor **M1**. In this connection, a rotary encoder E is provided on the rotary shaft **69** which projects to the upper end of the gear unit **67** and which rotates synchronously with the supporting shaft **61**.

The second transferring tool **59** fits up with the rotary bodies **77** and **79** on both ends of the supporting shafts **75**, **76** piercing through the basal part **41** of the lower block piece **40**, while the endless link cords **90** being made up of the timing belts are wound round between the rotary bodies **77**, **79**. The supporting shafts **75**, **76** can move up and down through the long holes **91** . . . which are provided on the side plates of the lower block piece **40** and which extend in the upward and downward direction, and are encouraged by the spring **93** being disposed at both ends of the supporting pin **92** which is spanned between the above-mentioned side plates in the middles of the supporting shafts **75**, **76**. On the other hand, the receiving rollers **95**, are provided aligning with the upper part of the rotary body **77**.

The receiving rollers **95** are fixed fast on both ends of the supporting shaft **96** which penetrate through the long hole of the front end part of the upper block piece **39** and are encouraged downward by the spring **94**. Accordingly, the running-upward line of the endless link cord **90** impinges upon both the under face of the receiving roller **95** and the under face of the endless link cord **65** of the first transferring tool **57**. Through this impingement, the running-upward line of the endless link cord **90** is located in the center between the up-and-down movement through the above-mentioned under passage **4A**, while the running-backward line of the endless link cord **65** is located in the center between the front and the rear of the vertical part of the passage **4A**.

Further, the running-backward line of the endless link cord **65** and the guiding piece **100** face each other spacing a small gap in between; this small gap continues to the above-mentioned lower passage **4A**, and constitutes the upper passage **4B** forming the above-mentioned passage **4** together with the passage **4A**. On the other hand, the projecting parts **101** of the keep tool **102** impinge against the above-mentioned running-backward line, while the guiding pieces **100** guide both side parts of the paper money B and also support vertically the paper money B together with the endless link cord **65** in between. In this connection, there is formed between and by the inner ends of the guiding pieces **100** the above-mentioned stuffing part **7** which makes the reverse face of the above-mentioned paper money B exposed.

In consequence, while supporting from inside and outside both side fringes of the paper money B being inserted into the inserting port **17** in a state of being developed, the transferring tool **5** can transfer them up to the stuffing part **7** in a state of being developed as they are.

There is disposed in the center of the above-mentioned passage **4** the sensor **6** for discriminating a paper money. In this example, a sensor **6** is the magnetic head having a pair of magnetoresistance elements and a magnet for bias, and is provided on the above-mentioned upper block piece **39** turning downward.

Further, there is additionally provided on a sensor **6** the pinch roller **70**. This pinch roller **70** is attached to a supporting shaft **71** which is spanned movably up-and-down on the side plate of the lower block piece **40**, is encouraged upward by a spring **72** being attached to the

above-mentioned supporting shaft **75**, and impinges softly upon the sensor **6**. On the other hand, there is disposed on the front end of a passage **4A** the detector **80** which is made up of a photosensor and which detects the insertion of the paper money B. Further, there are arranged at the circular arced part of the passage **4A** lever pieces **82** which operate the detector **81** by impinging against the transferred paper money B so as to tilt, and which return to their original positions soon after the paper money B has passed through to prevent the returning back of the paper money B.

In addition, there are provided on the above-mentioned stuffing part **7** of the passage **4** the sending tools **9**.

As shown in FIGS. **6** to **8**, the sending tool **9** forms the bearing pieces **127** in the backward direction on the inner end of the basal part **125** being made up of bent piece of crankshaped cross section, and pivots the long roller **126** in between parallel to the passage **4B**. Further, there are provided protuberantly turning backward on the outer end of the basal part **125** projecting pieces **130** being pinned on the bearing pieces **129** on the side plate **50** of the above-mentioned inner frame **19** above and below. Consequently, as shown in FIGS. **6** to **8**, the sending tool **9** is able to swivel around the pivoting point which is located in the vicinity and in front of both side ends of the passage **4B**. Through this swivelling, the roller **126** can swivel through the passage **4** from front to rear and through the stuffing part **7** up to the back of the above-mentioned guiding piece **100**.

On the other hand, there is attached to the inner frame **19** a swivelling tool **36** to swivel the sending tool **9**.

A swivelling tool **36** has sending motor **M2** and the substantially the same gear unit **131** as the above-mentioned gear unit **67**, and the disc-shaped cam pieces **132** are eccentrically fixed on both ends of the output shaft **133** projecting to both sides of the gear unit **131** and piercing through the side plates **50** while in the center of the cam piece **132** the pin **134** is protuberantly provided making eccentric the above-mentioned output shaft **133**. There is pivoted on the pin **134** a sliding piece **137** floatingly pierced through the slide shaft **136** extending upward and downward. The upper and lower ends of the slide shaft **136** are connected through the arms **140** being connected by joining piece **139** to the supporting pieces **142** projecting to the frontal face of the above-mentioned basal part **125**. There is spanned between the basal part **125** and the pin projecting from the front fringe part of the side plate **50** a spring **144**. Consequently the sending tools **9** can swivel when the sliding piece **137** describes a circular motion by the rotation of the cam piece **132**, and the slide shaft **136** pushes the basal part **125** backward through the arm piece **140**.

On the above-mentioned main body **2** of the discriminating apparatus **1**, there is formed the hooking part **13** for fitting up the stacker box **3**. In this example, the hooking part **13** has an L-shaped notch provided on the lower fringes of the hooks **146** provided protuberantly turning backward on the upper end part of the side plates **21** of the base frame **20**, and the rear fringe thereof is made circular arced. On the side face of the lower block piece **40** exposed by notching the upper corner part of the rear end of the lower plate part **23** of the side plate **21** in the form of a L-shape, there are provided hooking grooves **147** which extend upward and downward, but open at the upper end, and are arranged at the lower end with a receiving piece **150** being made up leaf springs.

The base box **10** of an stacker box **3** is fitted up with the upper plate **10** on the U-shaped frame having the rear plate **104** and the side plates **105**, and also the lower plate **107** being capable of opening and shutting.

The rear plate **104** is made up of the rectangular flat plate body slightly larger than the paper money B, whose lower fringe is provided with the U-shaped notched part **109**.

The side plate **105** is formed on the frontal fringes in such a manner that the narrow frontal pieces **115** may face each other turning inward, on the one hand, and on the other, there is provided on the lower fringe a projecting piece **111** being protuberantly provided with a hooking pin **110** in the inner face which is to be inserted in the above-mentioned hooking groove **147**. There are provided in the inner face of the middle part of the side plate **105** continuous guiding grooves **122** extending in the forward and backward direction. By inserting into this guiding groove **122** the projecting piece **121** protuberantly provided on both side fringes of the receiving plate **116** which is made up of the rectangular flat plate body arranged parallel to the rear plate **104**, the receiving plate **116** is supported movably at either end. What is more, this receiving plate **116** is encouraged forward by the spring **117** being arranged between itself and the rear plate **104**, where both side fringes thereof impinge against the above-mentioned frontal pieces **115**. Further, there is provided a notched part **109** also on the lower fringe of the receiving plate **116**.

The lower plate **107** raises erectly on both side fringes of the side pieces **112** which are in line with each of the outer faces of the side plate **105**. The upper front end part of the said side piece **112** is pinned on the above-mentioned side plate **105**, and is brought to a stop being left open as it is when the projecting part turning outward of the lock piece **114** made up of a spring plate attached to the side plate **105** engages the hole part **113** provided in the inner face of the rear end part of the side piece **112**.

As shown in FIG. **11**, the upper plate **106** is spanned over to the extension part **105A** of the upper end of the side plate **105**, which constitutes in this example the frame of the above-mentioned locking tool **15**.

The base box **10** can be inserted in midway between the above-mentioned hooks **146** by inserting the hooking pin **110** into the hooking groove **147** to swing forward, when the base box **10** can be attached to the main body **2** of the apparatus through the engagement of the hanging part being made up of fan-shaped projecting parts which are formed on the side faces of the base box **10** with the hooking part **13** of the above-mentioned hook **146**. In this connection, the base box **10** can be detached by being pushed down against the receiving piece **150** and swinging backward.

Being attendant on the attachment of the base box **10**, the above-mentioned opening part **11** which is formed between the frontal piece **115** on the front of the base box **10** comes to surround the stuffing part **7** of the above-mentioned passage **4**.

In consequence, as shown in FIG. **7** by the alternate long and two short dash line, the above-mentioned sending tools **9** send out the paper money B through the stuffing part **7** rearward, on the one hand, and on the other, the roller **126** pushes the paper money B against the receiving plate **116**, and holds the paper money B with the receiving plate **116** between. Further as shown

in FIG. 8, a sending tool 9 swings at the maximum angle in a state where the cam piece 132 rotates a half turn, while the roller 126 turns about to the rear of the frontal piece 115 while spreading both side parts of the paper money B. Consequently, the sending tool 9 in cooperation with the roller 126 tucks paper monies B through the above-mentioned opening part 11 into the stacker box 3. Further, when the cam piece 132 swings to make one revolution, then a sending tool 9 swings in the reverse direction. As the result, the receiving plate 116 shifts forward in accompaniment with the roller 126 and holds the paper money B between that receiving plate 9 and the frontal pieces 115. In this way, the paper monies B are received in tiers and within the stacker box 3.

The above-mentioned opening part 11 is closed by the covering plate 14. As shown in FIG. 9, this covering plate 14 is a rectangular flat plate body, which is to be inserted between the quiding pieces 151 being raised erectly from the upper end of the above-mentioned frontal piece 115 and the front fringe of the upper plate 106. When being inserted along the rear face of the frontal piece 115, the lower end of this covering plate is over the front fringe of the above-mentioned lower plate 107. Accordingly, the covering plate 14 shuts the opening part 11 and prevents the lower plate 107 to be left open on the basis of a state where the covering plate 14 impinges upon the front fringe of the lower plate 107.

As shown in FIGS. 9 to 11, the locking tool 15 is equipped with a sliding tool 154 the head of which engages through forward movement with the hooking holes 153 being fitted on the upper end part of the covering plate 14 and which thereby makes it impossible to draw out the covering plate 14 in the state of being closed; the stopper tool 155 makes it impossible for the sliding tool 154 being in a state of forward movement to move backward; and the releasing tool 156 which swings by the key K to release the stopper tool 155 from the hooked state.

As shown in FIG. 11, the sliding tool 154 is provided with the horizontal upper piece 160 and a side pieces 159 extending in the forward and backward direction, and takes the form of a turning-downward U-shaped cross section. The front end of the side piece 159 has a tapered face of an inclined angle of about 90°, and forms a fitting part 161 which fits into the above-mentioned hooking hole 153 of the covering plate 14. Further, there are provided on the front end part and the rear end part of the side plate 159 long holes 162, 163. On the other hand, there are raised erectly on the above-mentioned upper plate 106 at both sides in front and behind the standing pieces 164, and 165 along the inner face of the side pieces 159. The sliding tool 154 is able to slide forward and backward both by the slide shaft 166 passing through the above-mentioned long holes 162 and being spanned between the standing pieces 164 and by the slide pin 167 passing through the long hole 163 and fixing the inner end on the standing piece 165. Besides, there is provided on a under face of the side piece 159 the stair-shaped notch being provided with a hooking part 171 made up of a notched part of comparatively small height and an escape part 172 being made up of a notched part of comparatively large height and being set up jointly at the back of the former. Further, there is formed by bending on the upper fringe of the escape part 172 projecting pieces 173 which project inward, while the projecting piece 174 which projects outward is protuberantly provided at the back of the above-mentioned escape part 172 of the under fringes of the side piece 159. What is more, there is protuberantly provided on the rear end part of the upper fringe of the side piece 159 a turning-outward spring hanger bracket 176, on which one end of the spring 177 attached to the above-mentioned slide pin 167 is hooked and encourages the slide tool 154 forward.

In this example, the sliding tool 154 is hindered from forward movement by the stopper arm 157.

The stopper arm 157 is set up swingably between the standing pieces 164 through the above-mentioned slide shaft 166 to hook the front fringe of the above-mentioned projecting piece 173 using rear fringe thereof, and has a press part 179 and arm parts 190. The press part 179 projects forward beyond the inserted plane of the covering plate 14 to impinge against the covering plate 14 at the inserting time. The arm parts 190 rise erectly on both side fringes of the press part 179, and let the above-mentioned sliding shaft 166 pierce through the frontal end part thereof. Further, this stopper arm 157 is encouraged upward by the spring 191 being fitted on the sliding shaft 166. Further, there is provided on the above-mentioned upper piece 162 an escape hole 192 of the arm part 190.

The above-mentioned hooking state is released by the rear end of the arm part 190 being raised up at the inserting time of the covering plate 14.

The above-mentioned stopper tool 155 comprises arm parts 194 which are swingably fitted with a slide pin 167 on the standing piece 165 at the outer side of the above-mentioned side piece 159, and the joining piece 195 which is spanned between the front end of the under fringes of the arm parts 194 to interconnect them. On the other hand, there is protuberantly provided on a rear end of the arm part 194 the spring hanger bracket 196, on which the other end of the above-mentioned spring 177 is hooked. In consequence, the arm part 194 is encouraged upward at the front end by the spring 177, whereby the under face of the projecting piece 174 impinges upon the upper face of the head part of the arm part 194 at the going-back position of the sliding tool 154. On the other hand, the projecting piece 174 moves forward over the head of the arm part 194 in concert with the forward shifting of the sliding tool 154, so that arm part 194 raises up and thereby hooks the rear end of the projecting piece 174 at the front fringe of the arm part 194 to prevent the backward movement of the sliding tool 154.

The above-mentioned releasing tool 156 consists both of a main body 201 for locking which is clamped with screws on the fitting piece 199 being raised erectly on the rear fringe of the upper plate 105 and which is provided with rotary shaft 200 being put in rotation only by the corresponding key K, and of the key cam 202 which is fixed on the above rotary shaft 200 and which pushes down the joining piece 195 of the above-mentioned stopper tool 155 in accompaniment with the rotation of the above rotary shaft 200.

In this example, the locking tool 15 is provided with locking shaft 204 which makes it impossible to remove the stacker box 3 at the time of releasing the opening part 11 in cooperation with the above-mentioned sliding tool 154.

The locking shaft 204 is of a round bar form, and penetrates through the lower part of the hooking part 171 between the upper plate 106 and the sliding tool 154, the both end of which project from the hole parts 205 being provided on the above-mentioned extension parts 105A of the side plates 105 of the base box 10 and

that to both sides of the base box **10** at the upper part of the above-mentioned hooking part **12**. In this connection, the locking shaft **204** is encouraged forward by spring **206** being fitted on the inner face of the above-mentioned extension part **105A**. Further, there is provided on the upper part of the base box **10** the upper cover **207** covering the locking tool **15** inclusive of the above-mentioned projective parts of the both ends of the locking shaft **204**.

Consequently, at the time of setting up the stacker box **3** on the main body **2** of the apparatus, the base box **10** is inserted between the hooks **146** by inserting the hooking pins **110** into the hooking grooves **147** and thereby tilting the base box **10** forward, as mentioned above. At this time, as shown in FIG. **12**, the above-mentioned locking shaft **204** is located at the front end part of the hole part **205** while being encouraged by the spring **206** and impinges upon the under face of the hooking part **171**. And as shown in FIG. **13**, the locking shaft **204** is pushed by the hook **146** and shifts to the rear end part of the hole part **205**, when the hook **146** engages with the hanging part **12**, as shown in FIG. **14**, then the stacker box **3** is encouraged upward by the receiving piece **150** and goes up. In this state, the locking shaft **204** is inserted between the hook **146** and the hooking part **171** of the sliding tool **154** with the help of the spring **206**.

In this way, the hook **146** is hooked between the hanging part **12** and the locking shaft **204**, thereby making impossible the up-and-down movement of the stacker box **3** and the removal of the main body of the apparatus as well.

When required to remove the stacker box **3**, the opening part **11** must be closed by the use of the covering plate **14**. As shown in FIG. **15**, by inserting the covering plate **14** between the guiding pieces **151** to close the opening part **11**, the stopper arm **157** swings to allow the forward movement of the sliding tool **154**, as mentioned above, whereby the fitting part **161** of the sliding tool **154** having moved forward fits in the hooking hole **123** to make impossible the removal of the covering plate **14**. On the other hand, by the forward movement of the sliding tool **154**, the escape part **172** goes ahead to the upper part of the locking shaft **204**, whereby the locking shaft **204** becomes able to shift upward. In consequence, by pushing down the stacker box **3** against the above-mentioned receiving piece **150**, the hook **146** can push up the locking shaft **204**, thereby releasing the engagement of the hooking part **13** with the hanging part **12** and the stacker box **3** thus being able to be removed. As shown in FIG. **9**, the press part **179** swings at the time of inserting the covering plate **14**, presses down the upper end part of the paper money B . . . having been received within the stacker box **3**, and makes easy the insertion of the covering plate **14**.

Accordingly, since the stacker box **3** is closed at its opening part **11** by the covering plate **14** at the time of releasing the above-mentioned engagement, the paper monies B . . . having been received within the interior of the stacker box **3** are invisible to the person's sight and cannot to be taken out.

In order to take out from the detached stacker box **3** the paper monies B . . . having been received in the interior, the key cam **202** must be made to swing by rotating while inserting the key K into the key hole of the main body **201** for locking, and therewith to push down the joining piece **195** of the stopper tool **155**. In a state of the sliding tool **154** being possible to go back, the bottom fringe of the hooking hole **153** shifts on the under tapered face of the fitting part **161** by forcedly pulling out the covering plate **14** to cause the sliding tool **154** to go back. Then it becomes possible easily to extract the covering plate **14**. Such a state is shown in FIG. **9**. By the covering plate **14** being pulled out, the stopper arm **157** is raised up through the spring **191**, and the rear end of the arm part **190** hooks the projecting piece **173**, as mentioned above, and thus the forward movement of the sliding tool **154** is prevented. With the release of the opening part **11** the lower plate **107** also becomes releasable, as the result of which it is possible to pull out the paper monies B . . . having been received out of the opening part of the bottom face of the base box **10** in a state of lying in a stack as they are.

The locking tool **15** in this example makes impossible the removal of the stacker box **3** from the main body **2** of the apparatus in the case of the state of the opening part **11** being released, on the one hand, and on the other, the very removal of the stacker box **3** from the main body **2** of the apparatus is enabled by shutting the opening part **11** by the covering plate **14**.

FIGS. **16** and **17** further show other examples of the stacker box **3** where the covering plate **14** is to be housed in the interior of the stacker box **3** at the time of the opening part **11** being released. The covering plate **14** is pulled out from between the back plate **104** and the parting strip **213** being disposed in front of the plate **104**, by the sprocket **212** being turned round using the knob **211** provided on the side face of the side plate **105**, which then shuts the opening part **11**. What is more, in this shutting state, the sliding tool **154** goes ahead, the fitting part **161** fits into the hooking hole **153**, and in this way the covering plate **14** is locked. To release this locked covering plate **14**, the key cam **202** of the releasing tool **156** rotates, compresses the pushing piece **214** being raised erectly on the sliding tool **154** to make it go back, and then the knob **211** is forced to be turned.

In front of the main body of the apparatus, there is provided a printed base plate **83** of the control circuit being covered over by the cover **84**.

This control circuit compares a pattern signal S2 which is acquired from the output of the sensor **6** scanning the pattern being printed on a paper money B using the magnetic ink along the scanning route SCO extending in the longitudinal direction of the paper money B, with the standard pattern signal R, on the basis of which the genuineness of the paper money and the denomination is discriminated.

The control circuit comprises a microprocessor, ROM, RAM, an interface, and others, and is what is called a micon which works under program stored previously in ROM. To the interface are connected the above-mentioned sensor **6** through the an A/D converter, and also the detectors **80**, **81**, the rotary encoder E, the transferring motor **1**, the sending motor M2, the alarm, and others.

Description will be now directed to the behavior of the control circuit with the reference to FIG. **18** to **22**.

By inserting the paper money B in the passage **4**, the detector **80** detects the paper money B and the transferring motor **M1** rotates, then that paper money B is fed into the interior of the passage **4** with the aide of the transferring tool **5**, as mentioned above. The rotary encoder E outputs a timing signal for data sampling every 0.2 mm on the printed surface of the paper money B in this example. The above-mentioned sensor **6** has an electrical property much like a magnetic head having a

very wide gap, and outputs an analog signal S1 containing relatively wide pulses P1–P7 corresponding to the bordering lines **221** of the paper money B, the portrait part **222**, and the sum-indicating part **223**.

This analog signal S1 is converted by the A/D converter into, for example a, word of 8 bits sampled by the microprocessor every timing signal, thus is once stored within RAM. And the microprocessor processes the above-mentioned words stored within RAM and substracts the noise level from the value expressed by each word in order to eliminate the influence which noise has upon the discrimination of the paper money, and replaces the subtracted data with the original data. This data string is regarded as the above-mentioned pattern signal S2 for discriminating the paper money. This pattern signal S2 is compared with the standard pattern signal R stored previously within ROM.

The standard pattern signal R is one that prescribes the tolerance, in this example, the minimum of the amplitude centering around the reference level LO of the pattern signal S2, and that contains the standard pattern signals, for example, R1–R18 of **18** (=3 scanning routes ×3 denominations ×2 scanning directions) in total in the case of being scanned the above-mentioned scanning route SCO in the center and the scanning routes SC1, SC2 slightly shifting from both sides of the former with every denomination of the paper money to be discriminated (1 dollar, 5 dollars, 10 dollars) from both sides. The standard pattern signals R1–R18 are each compared with the pattern signal S2 in coincidence and non-coincidence.

The comparison is done in such a manner that the amplitude in the corresponding position of the pattern signal S2 and each of the standard pattern signals Rn (n=1 to 18) are compared. When the amplitude of the pattern signal S2 within the tolerance, in this example, is larger, it is considered as coincidence, but when the amplitudes of the standard pattern signals Rn are out of the tolerance, they are considered as non-coincidence. When the number of times of this non-coincidence is less than the value Dn predetermined for the then standard pattern signals Rn, it is decided that the standard pattern signals Rn coincide with the pattern signal S2.

The comparison consists in comparing the amplitudes in the corresponding positions of the pattern signal S2 and the standard pattern signals Rn. This corresponding position is decided by shifting word by word, for example, up to the 8 words maximum, at both sides of the reference position centering around, for example, the reference state obtained while allowing the above-mentioned bordering line approximately to coincide. In this way, the same comparison as mentioned above is done at each shifting state. To illustrate the above typically, FIG. **20** shows the above-mentioned reference state, which is an example to be judged that in the pattern signal S2, only the 11th word from left in the figure is led to non-coincidence, but the pattern signal S2 and the standard pattern signals Rn coincide each with other. FIG. **21** shows the state of having shifted the standard pattern signals Rn by 1 word to the right against the pattern signal S2 where the number of times of non-coincidence becomes **5**, which is judged that the pattern signal S2 does not coincide with the standard pattern signals Rn. Similarly, FIG. **22** shows the state where one word has been shifted to the left. This case also is judged as non-coincidence in the same manner as the above-mentioned.

Such a way of comparing by the pattern signal S2 is conducted on each of the standard pattern signals R1–R18. On the basis of the denomination of the coinciding standard pattern signals Rn, the genuineness of the paper money B and the discrimination of the denomination are carried out. In this connection, in the case of coincidences covering plural denominations or in the case where there are no coinciding denominations, it is judged that those are false paper monies or indiscriminable notes.

Therefore, the control circuit is able to make the discrimination regardless of the inserting direction of the paper money B being normal or reverse.

Further, it is able to compare the pattern signal S2 and the standard pattern signals Rn under the condition wherein the above-mentioned reference positions are made to coincide mutually and the conditions wherein those reference positions are made to laterally shift mutually spacing a small distance, in this example, by 0.2 mm on the paper money B, so that the discrimination is possible to be performed with high precision even when there occurs a discrepancy owing to the divergence in the sending direction of the paper money B or the tilt of the currency in the interior of the passage **4**.

As has been hitherto described, the paper money B being inserted into the passage **4** screens the detector **80** and at the same time drives the transferring motor M1. Thereby, the paper money B is fed into the inner part of the passage **4** by means of the first transferring tool **57** and passes through under the sensor **6**. On the other hand, as mentioned above, the sensor **6** reads the discriminating pattern printed on the paper money B and thereby discriminates the genuineness and the denomination. The paper money B being discriminated as a genuine note is guided by the first transferring tool **57** to the inner part of the passage **4B** and stops there. On the other hand, the paper money B has both end parts being held between the first transferring tool **57** and the guiding piece **100**, and its reverse surface is exposed by the stuffing part **7**. The control circuit detects by the detector **81** that the rear end of the paper money B has passed through the lever piece **82**, and stops the first transferring tool **57**. With the stoppage of the first transferring tool **57**, the swinging tool **36** goes into action, while the sending tool **5** stuffs the paper money B through both the stuffing part **7** and the opening part **11** into the stacker box **3**, as mentioned above, and then the control circuit outputs what is called a vending signal to the apparatus such as a vending machine.

When the paper money B is impossible to be discriminated, then the transferring motor M1 is thrown into reverse, so that the paper money B is sent back toward the inserting port **17**, simultaneously an alarm functions to give an alarm.

The sending tool **9** can send out smoothly the paper money by virtue of the rotatability of the roller **126**, and further is able to push the paper money B against the receiving plate **116** while spreading out surely even when it is a used and worn-out paper monies B. Therefore, without allowing the paper monies to pile one upon other when being folded as they are, the paper monies B are received regularly in piles within the stacker box **3**.

Incidentally, there can be utilized in the apparatus for discriminating paper money stacking the same **1** according to the invention such a sort as a photosensor other than the magnetic sensor in the capacity of the sensor **6**.

Also the transferring tool **5** may be formed by a single transferring tool without using the first and second transferring tools **57, 59**. Further the transferring tool **5** may be also formed by such as a couple of driving rollers and keep rollers without using endless link cords. On the other hand, the swinging tool **36** can be made using gears or cams of a certain-kinds even when those are able to swing the transferring tool **9**. The apparatus for discriminating paper money and stacking the same according to the invention can be modified into various embodiments, for example, by forming so as to discharge undiscriminatable paper money to the other end of the passage **4**.

As mentioned above, since the apparatus for discriminating paper money and stacking the same according to the invention is such a one that provides a locking tool which locks the covering plate to shut the opening part of the stacker box and that in a shutting state of the covering plate as it is at the time of removing the stacker box, the received paper money can be quickly collected together with the stacker box, thereby being able to promote the efficiency of the collecting operation of the paper money, the pilferages of the money can be prevented, the degree of safety is elevated, and such like. Many effects being brought about by this invention are immeasurable.

We claim:

1. An apparatus for discriminating paper money and stacking the same comprising:

a main body;

a passage in the main body including a stuffing part;

a sensor in the main body for discriminating paper money inserted in said passage to determine whether to accept said money;

transferring means, provided in said body, for transferring accepted paper money past said sensor into and outward of said stuffing part;

a stacker box removably mounted on said main body, said stacker box substantially sealed except for an opening surrounding said stuffing part when mounted, to receive said paper money transferred outward of said stuffing part into the stacker box;

engaging means including first means on said main body and second means on said stacker box engaging with said first means to mount said stacker box on said main body;

a shutter plate for shutting said opening, located in said stacker box along the inside of said opening, said shutter plate, when in a shut position in which said opening is shut, being located between the opening and the received paper money;

shutter locking means in said stacker box for locking said shutter plate in said shut position once inserted thereto, and

stacker locking means for locking said stacker box on said main body, said stacker locking means being released after said shutter plate is placed in the shut position.

2. An apparatus according to claim **1**, wherein:

said stacker box comprises a wall with said opening and includes

a receiving plate biased by spring means toward said wall to hold the received paper money between said wall and said receiving plate, and

a pressing plate disposed between an inlet for said shutter plate and a space for the received paper money, one end portion of said pressing plate being pivotally connected to the stacker box at a portion inward of the inlet for the shutter plate, the pivot thereof being substantially parallel to said wall and normal to the direction of the insertion of said shutter plate,

the other end portion of the pressing plate is extended across said inlet,

said shutter plate, when inserted, contacting and tilting said pressing plate, the tilted pressing plate pressing the received paper money away from said wall to provide a space for the shutter plate and guiding said shutter plate to said shut position between the opening and said received paper money.

3. An apparatus according to claim **1**, wherein said shutter locking means includes:

a bolt member supported on said stacker box slidably in a direction across the inserting direction of said shutter plate; and

spring means for biasing said bolt member toward the inlet for the inserted shutter plate;

the tip of said bolt member, when moved into a forward position, crossing the inlet for the inserted shutter plate, and

said shutter plate having a hole adapted to receive said tip when in said shut position,

whereby the shutter plate, when in said shut position, is locked by inserting the tip of the bolt member into the hole and is prevented from being removed from said shut position.

4. An apparatus according to claim **3**, wherein said shutter locking means further includes:

preventing means for preventing a backward movement of said bolt member from said forward position, and

a release key for deactivating said preventing means.

5. An apparatus according to claim **1**, wherein:

said first means of said engaging means includes a hook and a groove;

said second means includes a catcher and a pin both fixed on said stacker box to engage with said hook and groove respectively;

said hook being extended in a direction toward said stacker box and having an L-shaped hooking portion at an edge on the groove side;

said groove being extended in a direction substantially normal to said hook extending direction;

the depthwise direction of said groove being substantially normal to said hook extending direction;

one end of said groove on the hook side being opened for inserting said pin therein, and

the other end of the groove being provided with a spring for biasing the inserted pin toward said one end to press said catcher to said hooking portion,

whereby the stacker box is mounted on the main body by inserting said pin into said groove, pressing the pin against said spring, and engaging said hooking portion with said catcher, said stacker box being removed by pressing the pin against the spring, and releasing the engagement between said hooking portion and catcher.

6. An apparatus according to claim **5**, wherein:

said stacker locking means includes a locking member located on the opposite side of said hook with regard to said catcher and supported on said stacker box movably between a release position and a lock position,

said locking member, when in said lock position, secures said hook between the locking member and said catcher, and

said locking member, when in said release position, forms a space between the locking member and said catcher to break the engagement between said hooking portion and catcher,

whereby said stacker box cannot be removed from said main body when said locking member is in the lock position, and can be removed in the release position.

7. An apparatus according to claim 6, wherein said stacker locking means includes

a holding member for holding said locking member in said lock position, and

a releasing member actuated by said inserted shutter plate to release the locking member from the held state,

whereby said stacker box can be removed from said main body by inserting said shutter plate as a release key to said shut position.

8. An apparatus according to claim 7, wherein:

said stacker locking means includes a pressing plate jointed to said releasing member,

said pressing plate being disposed between an inlet for said shutter plate and a space for the received paper money,

one end portion of said pressing plate being pivotally connected to the stacker box at a portion inward of the inlet for the inserted shutter plate,

the pivot thereof being substantially parallel to said wall and normal to the direction of the insertion of said shutter plate,

the other end portion of the pressing plate being extended across said inlet, and

said stacker box including a wall with said opening and a receiving plate biased by spring means toward said wall to hold the received paper money between said wall and said receiving plate,

whereby the shutter plate, when inserted, contacts and moves said pressing plate, the moved pressing plate actuating said releasing member and pressing the received paper money away from said wall to provide a space for the shutter plate and guiding said shutter plate to said shut position between the opening and said received paper money.

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